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### STUDIES IN THE THEACEAE, XV A REVIEW OF THE GENUS ADINANDRA

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THE GENUS *Adinandra* was described by William Jack in Malay Misc. 2(7): 50. 1822. At that time two Malaysian species, *A. dumosa* and *A. sylvestris*, were described. Today the type-species, *A. dumosa*, has the widest distribution and is probably the best known of all the species in the genus.

Eighteen years later (1840), P. Korthals added five new species to the genus and described at the same time *Sarosanthra*, a new genus closely related to *Adinandra*. This later genus was short-lived. It was reduced to a synonym of *Adinandra* and the single species, *S. excelsa* Korthals, was given the name *A. Sarosanthra* by Miquel (Fl. Ind. Bat. 1(2): 477. 1859), who used the specific name *Sarosanthra* since Korthals (1840) had described earlier a species named *A. excelsa*.

The generic synonymy of *Adinandra* is very simple. The only described generic synonym is *Sarosanthra*, mentioned in the preceding paragraph. However, both Szyszylowicz (1893) and Melchior (1925) in their respective treatments of the Theaceae in Nat. Pflanzenfam. listed *Haenkaea* Usteri, Ann. Bot. 6: 117. 1793, as a synonym of *Adinandra* without any explanation. In Index Kewensis (vol. 1), under *Adinandra* Jack, is cited the synonym *Haenkaea* Usteri. This is merely a mechanical error which occurred in the compilation of the material for Index Kewensis. It is strange that the earlier date 1793 caused neither Szyszylowicz nor Melchior to investigate the generic status and the possible species described under *Haenkaea*. *Haenkaea* Usteri, in the alphabetical arrangement of Index Kewensis, is referred not to *Adinandra* Jack of the Theaceae, but to *Adenandra* Willd. of the Rutaceae, where it truly belongs.

By 1868 nearly twenty species, all from the Malay Peninsula or Netherlands East Indies, had been added to the genus by various authors. As a result the genus was considered to be localized to these areas. In 1868 Oliver (Fl. Trop. Afr. 1: 170) described *A. Mannii* from the island of St. Thomas in the Bay of Guinea off the west coast of Africa. This species

is quite different from the majority of species in the genus and several workers have suggested the possibility of generic segregation. A close study of the entire genus shows that the variations in *A. Mannii* are not sufficient for generic limitation.

In 1874 Dyer described *A. Griffithii* from East Bengal, and in 1878 *Cleyera Millettii* Hook. & Arn., of China, was transferred to the genus, thus extending the range to its northern limits. In 1905 the genus was first recorded from the Philippines, when Merrill introduced *A. luzonica*. It received its southernmost range in 1925 when Baker described *A. Forbesii* from New Guinea.

From 1822 until 1893 there had been no attempt on the part of any worker to treat all the species of the genus in a group. Frequently the genus was listed in local floras, but further than that little was offered as a composite study.

In 1893 Szyszyłowicz, in his treatment of the Theaceae for Nat. Pflanzenfam., although in very abbreviated form, listed the species of *Adinandra* and offered a key for their identification.

He introduced three new sections and separated them as follows:

Sect. I. Eleutherandra: Stamens free.

Sect. II. Euadinandra: Stamens in bundles.

Sect. III. Symphiandra: Stamens joined and disposed in a tube.

It is difficult to understand, considering the material available at the time, how Szyszyłowicz could separate the species into Sections II and III. He lists *A. Sarosanthra* Miquel in Sect. III and *A. lamponga* Miquel and *A. macrantha* Teijsm. & Binn. in Sect. II. I consider all three conspecific. I have studied an isotype of *A. Griffithii* Dyer and know only on the word of the author that the stamens are uniseriate. He lists *A. Miquelii* King, a combination never made by King, under Sect. III. *Adinandra Miquelii* is a synonym of *Ternstroemia bancana* Miq.

Melchior (1925), in the second edition of the same publication, accepted the treatment of Szyszyłowicz and added a fourth section as follows:

Sect. I. Eleutherandra Szyszy.: Style entire. Filaments free.

Sect. II. Euadinandra Szyszy.: Style entire. Filaments in bundles.

Sect. III. Symphiandra Szyszy.: Style entire. Filaments joined and disposed in a tube.

Sect. IV. Eleutherostyla Melch.: Styles free.

As noted, Melchior added a second character, the entire style, which combined the first three sections and separated them from his new section, *Eleutherostyla*, which was created to include *A. calosericea* Diels (1922), described three years earlier. In 1940 this new section was eliminated by the creation of a new genus, *Archboldiodendron*, to which *Adinandra calosericea* was transferred. The entire style cannot be attributed to all members of the other three sections created by Szyszyłowicz because a few species are known to have styles that are three-, four-, or five-parted. *Adinandra Griffithii* Dyer (Bengal), *A. lasiopetala* (Wight) Choisy (Cey-



lon), *A. filipes* Merrill and *A. nitida* Merrill (China), and *A. Macgregorii* Merrill (Philippine Isl.) are known to have parted styles, whereas in *A. quinquepartita* Kobuski (Borneo), in which the floral parts are described from a bud, the stigmas are distinctly five in number and the style, though apparently entire, is deeply five-sulcate.

However, in his treatment Melchior states that the knowledge of the stamens is too incomplete to group the species by sections, especially in Sections II and III, and so he groups them in geographical regions, namely Ceylon, Indo-Malaya, East Asia, and Papua. This proved to be an excellent method of treatment.

After a study of all the species described to date, I find that the majority of species, save perhaps *A. dumosa* Jack and *A. Millettii* (Hook. & Arn.) Benth. & Hook., are of rather limited range. These two mentioned species, although of more extensive geographical distribution, remain in their respective areas.

Although whenever possible the stamens are described in detail, I find it unfeasible to treat the species under the sections as outlined by Szyszylowicz and Melchior. Eight out of every ten herbarium specimens, and this is a conservative estimate, have been collected in the fruiting stage, and, as a result, many species have been described from the fruit alone. Furthermore, it is difficult, in working with herbarium material, to place a species definitely in its respective section even with the stamens present.

In this study I have employed the same method of treatment as used by Melchior and feel that in this manner the species can be identified more easily. In preparing the keys, I have avoided the use of the stamen characters when possible.

*Adinandra* Jack in Malay. Misc. 2 (7): 50. 1822 [repr. in Hooker, Comp. Bot. Mag. 1: 153. 1835; in Calcutta Jour. Nat. Hist. 4: 207. 1843, et in Miscel. Papers Indo-China II, 2: 271. 1887]. — Korthals, Verh. Nat. Gesch. Bot. ed. Temminck 103. 1840. — Choisy in Mém. Soc. Phys. Hist. Nat. Genève 1: 111 (Mém. Ternstr. 23). 1855. — Miquel, Fl. Ned. Ind. 1 (2): 477. 1859; Fl. Ned. Ind. Suppl. 1: 478. 1862. — Benth. & Hooker, Gen. Pl. 1: 182. 1862. — Miquel, Ann. Mus. Bot. Lugd.-Bat. 4: 103. 1868. — Dyer in Hooker f., Fl. Brit. Ind. 1: 281. 1874. — King in Jour. As. Soc. Bengal 59 (2): 187 (Mater. Fl. Malay Penin. 1: 127). 1890. — Szyszylowicz in Nat. Pflanzenfam. III. 6: 189. 1893. — Koorders & Valetton, Meded. 'S Lands Pl. 16: 219 (Bijdr. Boomsoort. Java 3: 219). 1896. — Ridley, Fl. Malay Penin. 1: 193. 1922. — Melchior in Nat. Pflanzenfam. ed. 2, 21: 143. 1925. — Craib, Fl. Siam. Enum. 1: 124. 1925. — Metcalf in Lingnan Sci. Jour. 11: 18. 1932. — Melchior in Notizbl. Bot. Gart. Mus. Berlin 11: 1076, 1097. 1934. — Gagnepain in Not. Syst. Mus. Hist. Nat. Paris 10: 112. 1941; in Fl. Gén. Indo-Chine, Suppl. 1: 282. 1943.

*Sarosanthera* Korthals, Verh. Nat. Gesch. Bot. ed. Temminck 103. 1840.

Flowers hermaphroditic. Sepals 5, imbricate, persistent, thick, concave, accrescent, unequal, gradually increasing in size from the outer lobes to the inner lobes. Petals 5, imbricate, connate at the base, glabrous or sericeous on the outer surface, the inner surface glabrous. Stamens  $\infty$ , 15-60, one- to five-seriate, adnate to the base of the corolla; filaments usually united, rarely free, unequal when 2- or more-seriate, pubescent or glabrous; anthers oblong, erect, basifixed, extrorse, hispid, very rarely

glabrous; connective projected into an apicule. Ovary pubescent or glabrous, 3- or 5-loculate, rarely 2- or 4-loculate, the ovules usually  $\infty$  (20-100) in each locule, rarely few (4), affixed with prominent placentae. Style 1, persistent, entire, rarely 3-5-fid; stigma 1, rarely 3-5, entire or lobed. Fruit indehiscent. Seeds  $\infty$  to few, usually minute, dark, shining, scrobiculate, the embryo inflexed, the cotyledons semi-terete.

Evergreen trees or shrubs, alternately branched. Leaves alternate, coriaceous, occasionally chartaceous. Flowers axillary, solitary, frequently in pairs; peduncles 1-flowered, recurved, seldom erect, 2-bracteolate, the bracteoles at the apex of the pedicel, opposite or alternate, persistent or caducous.

TYPE SPECIES: *Adinandra dumosa* Jack.

An amplification of the foregoing formal description, with observations on the characters used in specific delimitation throughout the genus, follows:

**Leaves:** Throughout the genus the leaves seldom furnish sound specific characters. Ordinarily the leaf is coriaceous. A very few species are known to possess chartaceous or subcoriaceous leaves. In size and shape one may find considerable variation on a single specimen. In most instances the leaves are obtuse, bluntly acuminate at the apex and tapering at the base. Occasionally there are consistent variations from this pattern, as found in the long-acuminate leaves of *A. acuminata* Korthals and *A. Bockiana* Pritzel and its variety, the cordate leaf-base of *A. cordifolia* Ridley and its variety, and the subsessile leaf-base of *A. subsessilis* Airy-Shaw. In these few instances specific delimitation may be based on the leaves.

The terminal leaf-buds and very young unfolding leaves possess characteristics helpful in indicating the degree of pubescence on the leaves. In any group of plants with coriaceous and evergreen leaves there is apt to be a question concerning the interpretation of the degree of pubescence of the leaves. The mature leaves may have been glabrous in the juvenile stage or they may have been extremely pubescent, later becoming glabrescent or even glabrous. In *Adinandra*, observation of the terminal leaf-bud offers an accurate means of determining the actual degree of pubescence or glabrosity of a given species. There are only a very few glabrous species, and in these cases only are the terminal leaf-buds strictly glabrous.

The veining as a whole is not an outstanding character, nor is it consistent. The majority of species fall into a group where the veins vary from 8 to 15 pairs. Very often the veins are obscure and of little use in identification. Exceptions may be found in *A. luzonica* Merrill, where even the veins of lesser degrees are of the same prominence as the primary veins, and in *A. myrioneuria* Kob., *A. polyneuria* Kob., *A. dasyantha* Korthals, and *A. phlebophylla* Hance, where the veins exceed more than twenty pairs in number; thereby presenting a conspicuous feature. The midrib is usually flattened or plane on the upper surface and semi-terete on the lower surface. In two species, *A. verrucosa* Stapf and *A. collina* Kob., the midrib on the lower surface is bisulcate.



**Pedicels:** The pedicel length is 1–2.5 cm. for the majority of species. Unless the pedicel is less than 0.5 cm. or more than 3 cm. long it can hardly be used as a delimiting factor. The pedicel is seldom erect, usually being recurved. Pubescence on the pedicel plays the same rôle as pubescence elsewhere.

**Bracteoles:** The persistence of the bracteoles is important. The greater number of species have persistent bracteoles, while in a smaller group of species the bracteoles are caducous. In the latter species the bracteoles may fall so early that their presence is recognized only by the scars, or the bracteoles may remain until anthesis before dropping away from the flower. Only in the persistent bracteoles and those remaining until anthesis can one find characters to be used for identification. Their position, shape and texture are of importance. In the majority of species, the bracteoles are opposite, at the apex of the pedicel, immediately below the calyx-lobes. When they are alternate, and alternate here means a variation up to 5 mm. in their positions, it is in the outer bracteole where the variation in position may be found. The inner bracteole arises immediately below the calyx-lobes, whereas the outer one is placed lower on the pedicel. In shape the bracteoles usually simulate the calyx-lobes. Often the two bracteoles vary considerably in size.

**Calyx:** Always persistent, the calyx-lobes vary considerably from the period of anthesis to that of mature fruit. Hence size, unless very small or exceedingly large, is of little importance. There is a marked variation in size in the lobes of a single calyx. The outer lobes are smaller, often more pubescent, and of heavier texture. In many species there is a gradation in size starting with the outer or smaller lobes and increasing in size to the largest or inner lobe. The margin of the inner lobes often is considerably more scarious than that of the outer lobes. The texture is of diagnostic importance. In the Eastern Asiatic species and those of the Philippine Islands, the texture of the calyx-lobes is of a decidedly thinner quality than can be found in the other groups or more tropical regions where the lobes are definitely thicker, often subligneous.

**Corolla:** The corolla remains as part of the flower for only a very short period. While still present it offers good characters in color, shape, length and pubescence. The lobes are always connate at the base; hence when dropping off the corolla falls in its entirety. White or cream is the color for the majority of species. Occasionally the corolla may be tinged with pink, and in British North Borneo and New Guinea a few species have purple lobes. In length the corolla may vary from a measurement equalling or slightly exceeding that of the calyx to three times the length of the calyx, as found in the two African species, *A. Mannii* Oliver and *A. Schliebenii* Melchior. Pubescence is an excellent character in the corolla. The species can be divided almost equally by this character. When present, the pubescence is usually of the appressed type and is concentrated on the median portion of the external surface. Occasionally one may find species where the pubescence extends over the complete



external surface. Unlike that in *Gordonia*, the pubescence is never found on the interior surface.

**Stamens:** The stamens offer many excellent characteristics, when present, to aid in identification. However, being adnate to the base of the corolla, they usually fall away with the corolla. They are arranged in the flower in series which vary in number from one to five. When in series, one finds that the filaments vary in length according to the number of series. The filaments are rarely free, but are connate for at least part of their length, usually that of the shortest filaments. Extreme difficulty is experienced working with dried material to determine the exact number of series. Stamens in a single series may average as low as fifteen in number (*A. Mannii* Oliver and *A. Schliebenii* Melchior), while those in several series will number as high as 55–60, as found in *A. Brassii* Kob. and *A. Forbesii* Bak. f. Variation in pubescence is considerable. In some species the filaments are glabrous, in others they are densely pubescent, and in still others one may find them pubescent on the upper portion adjacent to the anthers or on the dorsal surface only. The anthers are oblong, and with the exception of *A. Mannii* and *A. Schliebenii* are always extrorse-hispid. In only the two above-mentioned species are the anthers glabrous. In some instances an elongated apicule may be of diagnostic importance.

**Pistil:** Some of the best delimiting characters are found in the pistil. The style is persistent and either the ovary or fruit is present in every fertile specimen. The number of cells of the ovary has been little used even in descriptions. In immature flowers a cross-section is often difficult to obtain. In all species studied for this treatment the number of cells in the ovary and fruit are recorded. In a very few instances there is a variation within the species of number of cells in the ovary, and in such rare instances it is sometimes difficult to ascertain which is the usual number and which is the variation. The cells are for the most part quite clearly defined as to number. In several instances the placentae are of such length and consistency that they may be mistaken for cell-walls and as such they have obviously been interpreted in the past. Also, in a few species the cell-wall opposite the placentae may project so far into the cell that the branches of the placentae extend beyond the resulting indentation of the wall. A cursory study of such a dissection may very easily be misinterpreted. The fact that the ovary and the fruit are so filled with either ovules or seeds may very well lead to erroneous conclusions. Also, in rare instances the seeds may crowd the cells to such an extent that the walls are broken down and the seeds tend to displace the central axis or push into adjoining cells. However, these variations are exceptional.

The number of cells in the ovary and fruit of the majority of species is five. In all species where the ovary is five-celled the ovules are small and very many in number. The seeds, correspondingly, in the fruit are minute and usually number over a hundred. On the other hand, when the ovary and fruit are three-celled, the number of ovules and seeds is fewer and the seeds are larger than those in the five-celled species. The seeds here



measure up to 8 mm. long and seldom exceed ten in number for the entire fruit. Exceptions to this are rare but are found in *A. javanica* Choisy and *A. lasiopetala* (Wight) Choisy, where the fruit is three-celled but the seeds are minute and for all practical purposes countless. A few species have four-celled or two-celled ovaries. Of the two-celled group, *A. subsessilis* Airy-Shaw is interesting in that a single large seed is developed in each cell of the fruit.

Pubescence of the ovary plays an important rôle in identification. When pubescent, the ovary is usually densely so. This pubescence may be evanescent and the resultant fruit may be glabrescent. However, in such instances one may always find a few stray evidences of pubescence at the apex of the fruit just below its juncture with the style.

The style may be glabrous or pubescent. If the ovary is glabrous the style is also always glabrous. However, with a pubescent ovary one may find either a pubescent or glabrous style, depending upon the species. In any given species, however, the styles are usually consistent. In the majority of species the style is entire. However, in a few instances the style is divided into three or four parts, in accordance with the number of cells in the ovary. When the style is parted the number of stigmas is the same as the number of parts to the style. In a few species the style may be entire and the stigma lobed, in accordance with the number of cells in the ovary. In other species the style may be entire and the stigma distinctly five-parted.

The following review of species has been divided into five geographical groups, namely: (1) Eastern Asia; (2) Indo-Malaysia; (3) Philippine Islands; (4) New Guinea; and (5) Africa. Material has been borrowed from most of the leading American herbaria where the genus *Adinandra* has been deposited in abundance. Added material on critical specimens was obtained later from the Royal Botanic Gardens at Kew. The author is deeply grateful to the curators of these institutions for the privilege of examining their material. In the citations of specimens throughout this paper these institutions are abbreviated as follows:

- (A) Arnold Arboretum of Harvard University.
- (C) Chicago Museum of Natural History.
- (G) Gray Herbarium of Harvard University.
- (K) Royal Botanic Gardens, Kew, England.
- (M) Missouri Botanical Garden.
- (NY) New York Botanical Garden.
- (PBS) Philippine Bureau of Science, Manila, P.I.
- (US) United States National Herbarium.

#### EASTERN ASIATIC SPECIES

In reviewing the species of Eastern Asia and comparing them with those of the other geographical regions, as arranged in this study, one is impressed by the close relationship of all the species of this area and the basic similarity of their characters. Specific differentiation is not as clear

cut in this area as in the Indo-Malaysian area. Many species have been described on the basis of rather feeble variations. The focal species is *A. Millettii* (Hook. & Arn.) Benth. & Hook. Herbarium material has been rather plentiful for the Chinese species, and further material may show that the number of species listed below, although conservative, is not conservative enough.

The species described from Formosa and the Liu Kiu islands are very closely related to *A. Millettii* and its varieties. However, little could be done with these species, since the descriptions are often too meagre, and sufficient material for study lacking.

Almost equally sparse have been herbarium specimens from Indo-China. During the course of this study, there appeared a belated (although published in 1942) study of the Theaceae of Indo-China by Gagnepain (Not. Syst. Mus. Hist. Nat. Paris 10: 112-131. 1942). In this paper seven new species have been described. Fortunately, types of four of Gagnepain's species were found in the material gathered for this study and are treated in this section of the review. The remaining three, *A. annamensis*, *A. caudata*, and *A. donnaiensis*, are quoted at the end of this section. The original descriptions and citations are inserted in this paper in order to make these records as complete as possible. Material is essential before an attempt be made to relate them to better known species.

Immediately following is a chart of the characters used in separating the majority of the species of *Adinandra*. Under each element are listed the differences, and the species are recorded, whenever possible, under these differences. This chart has been helpful to me in the present study and it is hoped that it may be of assistance to other workers. Accompanying charts will be found in the two following groups.

#### CHART FOR EASTERN ASIATIC SPECIES OF ADINANDRA

Bracteoles		Calyx-lobes	
PERSISTENT	CADUCOUS	PUBESCENT	GLABROUS
<i>Bockiana</i>	<i>Bockiana</i>	<i>Bockiana</i>	<i>Bockiana</i>
<i>tonkinensis</i>	<i>Bockiana</i>	<i>tonkinensis</i>	<i>Bockiana</i>
<i>epunctata</i>	<i>acutifolia</i>	<i>epunctata</i>	<i>acutifolia</i>
<i>glischroloma</i>	<i>filipes</i>	<i>filipes</i>	<i>Howii</i>
<i>hirta</i>	<i>glischroloma</i>	<i>glischroloma</i>	<i>laotica</i>
<i>Millettii</i>	<i>glischroloma</i>	<i>glischroloma</i>	<i>nitida</i>
<i>obtusissima</i>	<i>jubata</i>	<i>hirta</i>	<i>Millettii</i>
<i>nitida</i>	<i>glischroloma</i>	<i>glischroloma</i>	<i>Millettii</i>
<i>ryukyuensis</i>	<i>macrosepala</i>	<i>jubata</i>	<i>formosana</i>
<i>Zen-Tsiroi</i>	<i>hainanensis</i>	<i>glischroloma</i>	<i>Millettii</i>
	<i>Howii</i>	<i>macrosepala</i>	<i>obtusissima</i>
	<i>laotica</i>	<i>hainanensis</i>	
	<i>lasiostyla</i>	<i>lasiostyla</i>	
	<i>megaphylla</i>	<i>megaphylla</i>	
	<i>Millettii</i>	<i>obtusissima</i>	
	<i>Millettii</i>	<i>ryukyuensis</i>	
	<i>formosana</i>	<i>yaeyamensis</i>	
	<i>yaeyamensis</i>	<i>Zen-Tsiroi</i>	



Corolla-lobes		Filaments	
PUBESCENT	GLABROUS	PUBESCENT	GLABROUS
<i>Bockiana</i>	<i>glischroloma</i>	<i>glischroloma</i>	<i>Bockiana</i>
<i>Bockiana</i>	<i>hirta</i>	<i>hirta</i>	<i>Bockiana</i>
<i>acutifolia</i>	<i>laotica</i>		<i>acutifolia</i>
<i>Bockiana</i>	<i>Millettii</i>		<i>Bockiana</i>
<i>tonkinensis</i>	<i>Millettii</i>		<i>tonkinensis</i>
<i>epunctata</i>	<i>formosana</i>		<i>epunctata</i>
<i>glischroloma</i>	<i>Millettii</i>		<i>glischroloma</i>
<i>glischroloma</i>	<i>obtusissima</i>		<i>glischroloma</i>
<i>jubata</i>	<i>nitida</i>		<i>jubata</i>
<i>glischroloma</i>			<i>glischroloma</i>
<i>macrosepala</i>			<i>macrosepala</i>
<i>hainanensis</i>			<i>hainanensis</i>
<i>lasiostyla</i>			<i>laotica</i>
<i>megaphylla</i>			<i>lasiostyla</i>
			<i>megaphylla</i>
			<i>Millettii</i>
			<i>Millettii</i>
			<i>formosana</i>
			<i>Millettii</i>
			<i>obtusissima</i>
			<i>nitida</i>

Ovary		Style	
PUBESCENT	GLABROUS	PUBESCENT	GLABROUS
<i>Bockiana</i>	<i>Howii</i>	<i>epunctata</i>	<i>Bockiana</i>
<i>Bockiana</i>	<i>laotica</i>	<i>filipes</i>	<i>Bockiana</i>
<i>acutifolia</i>	<i>nitida</i>	<i>glischroloma</i>	<i>acutifolia</i>
<i>Bockiana</i>	<i>ryukyuensis</i>	<i>glischroloma</i>	<i>Bockiana</i>
<i>tonkinensis</i>	<i>Zen-Tasiroi</i>	<i>hirta</i>	<i>tonkinensis</i>
<i>epunctata</i>		<i>glischroloma</i>	<i>Howii</i>
<i>filipes</i>		<i>jubata</i>	<i>laotica</i>
<i>glischroloma</i>		<i>glischroloma</i>	<i>Millettii</i>
<i>glischroloma</i>		<i>macrosepala</i>	<i>Millettii</i>
<i>hirta</i>		<i>hainanensis</i>	<i>formosana</i>
<i>glischroloma</i>		<i>lasiostyla</i>	<i>nitida</i>
<i>jubata</i>		<i>megaphylla</i>	<i>ryukyuensis</i>
<i>glischroloma</i>		<i>Millettii</i>	<i>yaeyamensis</i>
<i>macrosepala</i>		<i>obtusissima</i>	<i>Zen-Tasiroi</i>
<i>hainanensis</i>			
<i>lasiostyla</i>			
<i>megaphylla</i>			
<i>Millettii</i>			
<i>Millettii</i>			
<i>formosana</i>			
<i>Millettii</i>			
<i>obtusissima</i>			
<i>obtusissima</i>			
<i>yaeyamensis</i>			

## Ovary

FIVE-CELLED	THREE-CELLED
<i>glischroloma</i>	<i>Bockiana</i>
<i>glischroloma</i>	<i>Bockiana</i>
<i>hirta</i>	<i>acutifolia</i>
<i>glischroloma</i>	<i>Bockiana</i>
<i>jubata</i>	<i>tonkinensis</i>
<i>glischroloma</i>	<i>epunctata</i>
<i>macrosepala</i>	<i>filipes</i>
<i>hainanensis</i>	<i>Howii</i>
<i>laotica</i>	<i>lasiostyla</i>
<i>megaphylla</i>	<i>Millettii</i>
	<i>Millettii</i>
	<i>formosana</i>
	<i>Millettii</i>
	<i>obtusissima</i>
	<i>nitida</i>
	<i>obtusissima</i>

## KEY TO EASTERN ASIATIC SPECIES

- A. Ovary pubescent; fruit pubescent or obviously glabrescent.
- B. Style glabrous.
- C. Calyx-lobes ovate-deltoid, long-acuminate, widest near the base; corolla-lobes glabrous.
- D. Leaves usually entire; pedicels up to 2 cm. long. (Eastern China) .... 1. *A. Millettii*.
- DD. Leaves usually serrulate; pedicels up to 3 cm. long. (Formosa)..... 1a. *A. Millettii* var. *formosana*.
- CC. Calyx-lobes rounded or broadly obtuse, usually blunt, occasionally rounded and sharply apiculate, not long-acuminate, widest portion remote from the base; corolla-lobes pubescent.
- D. Terminal buds, the under surface of the leaves, the current season's growth of branchlets, and the flower parts covered with a loose, spreading pubescence in varying degrees of density, not appressed.
- E. Pubescence dense, persistent on the above-mentioned parts. (Kwangsi, Kweichow, Szechuan)..... 2. *A. Bockiana*.
- EE. Pubescence dense only in the young stages with a distinct tendency toward glabrescence at maturity.
- F. Leaves long-acuminate, the margins entire. (Fukien, Hunan, Kwangsi, Kweichow)..... 2a. *A. Bockiana* var. *acutifolia*.
- FF. Leaves obtuse at the apex, the margins serrulate. (Liu Kiu Islands)..... 14. *A. yaeyamensis*.
- DD. Terminal buds, the under surface of the leaves, the current season's growth of branchlets, and the flower parts covered with a short appressed pubescence. (Indo-China).... 2b. *A. Bockiana* var. *tonkinensis*.
- BB. Style pubescent.
- C. Leaves large, 20-24 cm. long, 4-7 cm. wide, the midrib on upper surface always finely pubescent..... 3. *A. megaphylla*.
- CC. Leaves seldom 15 cm. long, the midrib on upper surface always glabrous.
- D. Flowers axillary, in twos and threes, only occasionally solitary; pubescence on under surface of leaves (especially young leaves) very long and dense, projecting beyond the margin, noticeable from the upper surface.



- E. Bracteoles caducous; style densely pubescent two-thirds the entire length.
- F. Pubescence on under surface of the older leaves tending toward glabrescence along the midrib and blade, maintaining denseness along the margin.
- G. Calyx-lobes 6-7 mm. long, occasionally up to 10 mm. long in fruit. (Kwangtung, Kwangsi).....4. *A. glischroloma*.
- GG. Calyx-lobes 11-14 mm. long. (Chekiang, Fukien).....4a. *A. glischroloma* var. *macrosepala*.
- FF. Pubescence on the under surface of the older as well as the younger leaves a dense ferrugineous iridescent tomentum up to 5 mm. long. (Kwangtung).....4b. *A. glischroloma* var. *jubata*.
- EE. Bracteoles persistent; style densely pubescent the entire length. (Indo-China).....4c. *A. glischroloma* var. *hirta*.
- DD. Flowers axillary, solitary; pubescence on the under surface of the leaves, when present, not projecting beyond the margin so as to be noticeable from upper surface.
- E. Style 3-parted; pedicel ca. 4 cm. long. (Kwangsi).....5. *A. filipes*.
- EE. Style entire; pedicel 2.5 cm. long or less.
- F. Leaves distinctly dark punctate-dotted on the lower surface; ovary and fruit 5-celled. (Hainan, Kwangtung).....6. *A. hainanensis*.
- FF. Leaves without dark punctate-dots on the lower surface; ovary and fruit 3-celled.
- G. Bracteoles caducous. (Formosa).....7. *A. lasiostyla*.
- GG. Bracteoles persistent.
- H. Pedicels short, seldom over 0.7 cm. long; filaments pubescent; fruit small (ca. 5 mm. diam.), the seeds normal in size (2-3 mm. long), but few (9-10) in number. (Hainan).....8. *A. epunctata*.
- HH. Pedicels up to 2.5 cm. long; filaments glabrous; fruit many-seeded (100 or more). (Formosa).....1b. *A. Millettii* var. *obtusissima*.
- .....15. *A. obtusissima*.
- AA. Ovary and fruit glabrous.
- B. Entire plant glabrous, except for the terminal buds and the branchlet growth of current year.
- C. Ovary and fruit 5-celled. (Indo-China).....9. *A. laotica*.
- CC. Ovary and fruit 3-celled.
- D. Style 3-parted; calyx-lobes ca. 15 mm. long, 7-9 mm. wide; bracteoles persistent. (Kwangsi, Kwangtung).....10. *A. nitida*.
- DD. Style entire; calyx-lobes ca. 8 mm. long, 5 mm. wide; bracteoles caducous. (Hainan).....11. *A. Howii*.
- BB. Under surface of the leaves, pedicels, and calyx-lobes, as well as the terminal buds and branchlets pubescent. (Liu Kiu Islands).....12. *A. ryukyuensis*.
- .....13. *A. Zen-Tasiroi*.
1. *Adinandra Millettii* (Hooker & Arnott) Benth. & Hooker f. ex Hance in Jour. Bot. 16: 9. 1878. — Maximowicz in Bull. Acad. Imp. Sci. St.-Petersb. 31: 17. 1886 (excl. Liukiu ins. spec.). — Szyszyłowicz in Nat. Pflanzenfam. III. 6: 189. 1893. — Melchior in Nat. Pflanzenfam. ed. 2, 21: 144. 1925. — Rehder & Wilson in Jour. Arnold Arb. 8: 177. 1927. — Metcalf in Lingnan Sci. Jour. 11: 30. 1932. — Merrill in Jour. Arnold Arb. 19: 55. 1938.
- Cleyera Millettii* Hooker & Arnott, Bot. Beechey Voy. 171, t. 33. 1841.
- Adinandra Drakeana* Franchet in Nouv. Arch. Mus. Paris, sér. 2, 5: 208 (Pl. David. 56). 1882. — Szyszyłowicz in Nat. Pflanzenfam. III. 6: 189. 1893.

*Adinandra Hemsleyi* Handel-Mazzetti ex Metcalf in Lingnan Sci. Jour. 11: 19. 1932, in obs., nomen.

DISTRIBUTION: China (Kwangtung, Fukien, Anhwei, Chekiang, Kiangsi, Kwangsi).

KWANGTUNG: Summit of Pakwan Mt., above Canton, *T. Sampson 15598* (G), May 1870. — White Cloud Hills, Canton, at summit, *T. Sampson 1239* (C), May 25, 1879. — Canton and vicinity, *C. O. Levine 613* (C, G, M, US), April 24, 1917, 1230 (M), Aug. 30, 1917. — Loh Fau Shan, *C. O. Levine 2069* (A, M), May 8, 1918. — Poon Yue Distr., *C. O. Levine 3199* (A, G, M), Sept. 4, 1918. — San-on Distr., Ng-Tung Shan, mountain forest, alt. 900 m., *T. M. Tsui 219* (M, NY, US), April 1932 (woody, 1 m. high with white flowers). — Lo Chong, *C. L. Tso 20446* (A), May 11, 1929 (small tree). — Near Yiu-shan, in woods, alt. 800 m., *R. Mell 769* (isotype of *A. Hemsleyi*, A), Sept. 5, 1917. — Tapu Distr., Tai Mo Shan, Wong Pan Ch'a, dry steep slope in sandy soil, *W. T. Tsang 21076* (A, NY), July 5, 1932 (shrub 2 m. with edible black fruit). — Mei (Kaying) Distr., Yam Na Shan (Yit Nga Shan), Wong Pan Ch'a Shue, along roadside of dry, clay meadow, *W. T. Tsang 21353* (A, NY), Aug. 4-31, 1932 (erect, woody, 3 m. with edible black fruit). — Wung Yuen Distr., Tsing Ngan Shan, Wong chuk I and vicinity, clay thickets on steep dry slopes, *S. K. Lau 2025* (A), Aug. 16-31, 1931 (woody, 8 m.). — Hongkong, New Terr., Wu-kau-tin, in open woods, *Y. Tsiang 2965* (A, C, NY, US), Aug. 13, 1929 (low shrub with deep purple fruit). — Sin-fung Distr., Lo-lo-ha village, Sha Lo Shan, abundant in forest, *Y. W. Taam 928* (A), July 1938 (7 m. high; fruit black, edible). — Hongkong, *C. Ford s. n.*, (A, NY). FUKIEN: Lui Sang, Kuliang and vicinity, rich woods, alt. 800 m., *H. C. Chen 1065* (A), July 20, 1925. — Kutien, *H. H. Chung 4021* (A, NY), May 26; 1928. — Ne Lau San, Dionglow and vicinity, wooded hillside, *Y. T. Lin 11720* (M), Aug. 6, 1926. — Yenping, Peh Men Wei, near north gate, rocky hillside, *K. H. Chou 8748* (M), Aug. 13, 1926. — Pehling, Minhow Hsien, in thickets, *H. H. Chung 2074* (A), Aug. 3, 1923 (shrub 1 m.). — Foochow, I-Su-Shan, *H. H. Chung 2814* (A, M), Aug. 13, 1924 (shrub 2 m.). — Yenping, Cha-ping, on slopes, alt. 730 m., *H. H. Chung 2846* (A), July 30, 1924 (shrub 1 m.). — Minhow Hsien, Kushan Monastery, in shady woods, *H. H. Chung 2265* (A), Aug. 17, 1923 (tree or shrub 3-4 m.). — Chuanchow, *H. H. Chung 3097* (M), April 23, 1925 (shrub). — Foochow, Kushan, *H. H. Chung 3810* (A), Aug. 18, 1925 (shrub). — Inghok, Fang Kwang Yen, *H. H. Chung 4047* (A), May 10, 1928. — Kuliang, *H. H. Chung 6445* (A), July 7, 1926 (shrub with white flowers). — Kushan, brookside, *H. H. Chung 7826* (A), Aug. 22, 1926. ANHWEI: Li Kan, along banks of partially wooded stream, alt. 100 m., *R. C. Ching 3153* (A), Aug. 7, 1925 (shrub 5 m. with smooth, gray bark). — Kimen, *N. K. Ip 7671* (US), Aug. 19, 1924. CHEKIANG: Tsing Tsiens, on hill near rocks, *Y. L. Keng 79* (A), July 21, 1926 (low shrub with the fruit solitary in the axils). — Tsing Tsiens, on mountain near roadside, *Y. L. Keng 144* (A), July 26, 1926 (1 m. high). — S. Ventang, shady woods, alt. 200 m., *H. H. Hu 227* (A), Aug. 26, 1920 (shrub 2-3 m. with edible black fruit). — 150 li south of Ping Yung, alt. 70 m., *R. C. Ching 1984* (A, G, US), July 4, 1924 (shrub 8 m.; nodding flowers with green calyx and corolla, pistil purple). — 15 li northeast of Tai Suan, open bushy slope, alt. 500 m., *R. C. Ching 2207* (A, US), July 22, 1924 (big shrub 7 m.). KWANGSI: Yung Hsien, Ta Tso Shan, on hillside and in forest, alt. 380 & 540 m., *A. N. Steward & H. C. Cheo 819, 905* (A, NY), Aug. 1933 (shrub or tree 6-10 m. with whitish gray bark). — Yao Shan, Ping Nan, thin woods near ridge, *C. Wang 39171* (A), May 17, 1936 (shrub with white flowers). KIANGSI: Eastern Kiangsi, *A. David s. n.* (photo of type of *A. Drakeana*, A), 1873 ("petit arbre, à fleurs blanches, sans odeur"). — Lungnan Distr., Oo Chi Shan, near Lam Uk Tung village, dry steep slope in clay forest, *S. K. Lau 4424* (A, US), Sept. 1934 (5 m. high). — Kiennan Distr., Sai Hang Cheung, near Tung Lei village, *S. K. Lau 3958* (A, US), July 1934. — On trail between Kit-shan and Hong San, bushy hillside, alt. 580 m., *J. L. Gressitt 1425* (A, M), June 21, 1936 (shrub 1 m. high with pink flowers). — Hsin Feng Hsien, shady hillside, alt. 650 m., *H. H. Hu 1012* (A), May 31, 1921 (shrub 1 m. high with white flowers). — Ling Chuan, near Siang-ton-ton, in small woodland, alt. 100 m., *Y. Tsiang 9851* (NY), June 17, 1932 (shrub 1-2 m. high).



Shrub or small tree. Branchlets glabrous, terete, grayish brown, the very young branchlets and terminal buds pilose in varying degrees. Leaves coriaceous, oblong-elliptic, 4.5–9 cm. long, 2–3 cm. wide, acuminate, bluntly acuminate to nearly obtuse at the apex, acute at the base, the very young unfolding leaves densely pubescent, the mature leaves showing green, glabrous above, lighter green, glabrous or glabrescent, occasionally with light scattered appressed pubescence beneath, the margin generally entire, occasionally (on the same specimen) lightly denticulate along the upper half, the veins obvious on both surfaces but not conspicuous, the petiole short, ca. 3 mm. long, usually glabrous, rarely slightly pubescent. Flowers axillary, solitary; pedicels up to 2 cm. long, slender, glabrous; bracteoles 2, quickly caducous, alternate, near the apex of the pedicel when (rarely) present in the young buds, similar to the calyx-lobes, ca. 2 mm. long; calyx-lobes 5, imbricate, subequal, ovate-deltoid, 7–8.5 mm. long, 4–6 mm. wide, quite sharply pointed at the apex, widest at the base, glabrous or glabrescent, rarely slightly appressed-pubescent on the exterior surface, the margin subscarious, both glandular-denticulate and ciliate; corolla-lobes 5, connate at the base, glabrous, white, similar to the calyx-lobes in size and shape, barely exceeding the latter in length, oblong-ovate, up to 8.5 mm. long, ca. 4–5 mm. wide, slightly apiculate, widest at the base; stamens ca. 25, seemingly uniseriate, rather uniform in size, 7–8 mm. long, the filaments ca. 3 mm. long, glabrous, somewhat dilated, measuring nearly 0.5 mm. across, quite free from each other, adnate to the base of the corolla, the anthers 2–3 mm. long, broadly linear, up to 1 mm. across, covered with a dense white pubescence, the apicule 1–1.5 mm. long; ovary nearly globose, tapering slightly at the apex, white-pubescent, 3-celled, multi-ovulate, the style glabrous, entire, ca. 9 mm. long, the stigma obtuse, simple. Fruit glabrescent, with evidence of some straggling pubescence, subglobose, ca. 7–8 mm. diameter, many-seeded, the seeds minute, black, shining.

*Adinandra Millettii* is the earliest described species of the genus from China. It has been most often collected, shows the widest distribution, and probably is the oldest Chinese species phylogenetically. In these respects it compares very favorably with the type, *A. dumosa* Jack, from Indo-Malaya.

The species itself is confined, according to the material available for this study, to the mainland of China; it ranges along the southeastern coast including the provinces of Chekiang, Kiangsi, Fukien and Kwangtung, and extends inland and westward to include Kwangsi and Anhwei.

Two varieties are found in Formosa, *A. Millettii* var. *formosana* (Hayata) Kob. (the erstwhile *A. formosana* Hayata) and *A. Millettii* var. *obtusissima* Kob. Closely allied to *A. Millettii* is the species *A. Bockiana* Pritzl and its two varieties *A. Bockiana* var. *acutifolia* (Hand.-Mazz.) Kob. (*A. acutifolia* Hand.-Mazz.) and *A. Bockiana* var. *tonkinensis* Kob. All these entities have many diagnostic characters in common, i. e. the small flowers, the calyx-lobes thin in texture, the stamens similar in number, size, shape and arrangement, the filaments showing a definite and characteristic dilation toward the anthers, and the 3-celled ovary with a distinct spreading grayish pubescence which becomes glabrescent in the fruit.

The corolla-lobes are similar in size, hardly extending beyond the calyx-lobes.

The characters separating the two species are the shape of the calyx-lobes, the pubescence on the corolla-lobes, and the leaf-shape. These characters, none too strong, are consistent, however, in the two species. Whereas, in *A. Millettii* and its varieties the calyx-lobes are always long-acuminate with the attenuation starting near the base, in *A. Bockiana* and its varieties the calyx-lobes are more rounded, occasionally abruptly apiculate but not long-tapering. In *A. Millettii* the corolla-lobes are always glabrous on the external surface whereas in *A. Bockiana* the corolla-lobes are always pubescent on the median portion of the external surface. In the latter species the leaves are larger and usually long-acuminate.

As might be expected, from the extensive range of the species, there is considerable variation in *A. Millettii*, especially in the leaves. One of the earliest collected specimens and perhaps the most cited (*Sampson 15598*, Pak-wan, Kwangtung) shows, on the same sheet, branchlets in which the leaves vary from obtuse to long-acuminate. This same variation can be found on several other specimens. Pubescence is another variable character. Generally speaking, except for the current year's growth, *A. Millettii* may be considered quite glabrous, quickly losing its early pubescence. However, in some instances this glabrescence is less extensive, hence scattered hairs may be found on the undersurface of the leaves, the pedicels, and the calyx-lobes.

In describing the stamens, Hooker and Arnott refer to the filaments as hairy and the anthers glabrous. The illustration accompanying the description portrays them thus. In the dissections made for this study, the filaments were always glabrous and the anthers pubescent. The reverse condition, as given by Hooker and Arnott, would be very unusual for this genus.

A photograph and fragment of the type of *A. Drakeana* Franchet, collected by A. David in Kwangsi in 1873 and deposited in the Museum d'Histoire Naturelle, Paris, show clearly that *A. Drakeana* is synonymous with *A. Millettii*. Probably Franchet was unaware of the existence of *A. Millettii* when he proposed his new species, because his suggested relationships are with the Indo-Malaysian species *A. dumosa* Jack and *A. integerrima* T. Anderson rather than with *A. Millettii*.

Another name, found on herbarium specimens but never adequately published, is *A. Hemsleyi* Handel-Mazzetti. Metcalf, evidently with some authority, stated that Handel-Mazzetti had abandoned this name and never published the species because he felt the relationship was too close to *A. Millettii*. *Mell 769* from Kwangtung is a representative of this distribution.

- 1a. *Adinandra Millettii* (Hooker & Arnott) Benth. & Hooker f. ex Hance var. *formosana* (Hayata), comb. nov.

*Adinandra formosana* Hayata in Jour. Coll. Sci. Tokyo 22: 45. 1906; in Jour. Coll. Sci. Tokyo 30 (Art. 1): 42. 1911. — Kanehira, *Formosan Trees* 51, fig. 1917; revised ed. 452, fig. 409. 1936. — Melchior in Nat. Pflanzenfam. ed. 2, 21: 149. 1925. — Sasaki, Cat. Governm. Herb. 346. 1930.



*Adinandra pedunculata* Hayata in Jour. Coll. Sci. Tokyo 30 (Art. 1): 43. 1911. — Kanehira, Formosan Trees 54, fig. 1917. — Melchior in Nat. Pflanzenfam. ed. 2, 21: 145. 1925.

*Adinandra hypochlora* Hayata, Icon. Pl. Formos. 3: 44. 1911. — Kanehira, Formosan Trees 52. 1917. — Melchior in Nat. Pflanzenfam. ed. 2, 21: 145. 1925. — Sasaki, Cat. Governm. Herb. 347. 1930.

DISTRIBUTION: Formosa.

FORMOSA: Rengachi, *T. Hayashi* 21213 (A), June 1924. — Bankinsing, *A. Henry* 514 (A), 1583 (A, US). — Taitun, *U. Faurie* 1861 (A), April 1915. — Mt. Tikusi, *T. Kawakami* & *Y. Simada* W 9 (A), May 1915. — Taihoku, Mt. Sozan, *S. Susuki* s. n. (A), Aug. 26, 1931. — Vicinity of Kūrun (Kürung), *T. Tanaka* 340 (A, NY, US), Aug. 17, 1929. — Taihoku-shu, Shinten, *T. Tanaka* 11178 (C, NY, US), July 24, 1932. — Taihoku, Mt. Sozan, *S. Sasaki* 21627 (A, NY), Aug. 14, 1927. — Tamsuy, *R. Oldham* 37 (G), 1864.

This variety differs from the species in several characteristics, none of them sufficiently consistent to warrant specific status. The leaves of the variety are usually distinctly serrate along the upper half of the margin. Generally speaking, the leaves of the species proper are quite entire. However, throughout all the material of the species examined one may occasionally find serration along the margin. The specimen of this variety most closely resembling typical *A. Millettii* from Formosa is *Oldham* 37. Here the margin of the leaves is more nearly entire with slight evidence of serration. The shape of the leaf is extremely varied. However, this same variation is found in the species. In *Sasaki* 21627 one may note, on a single branch, leaves which are obtuse, bluntly acuminate, or acuminate at the apex.

The pedicels are generally longer, in rare instances attaining 3 cm. (*Henry* 514) in length. However, 2 cm. is the average length. Both the species and the variety have the same type of thin scattered pubescence on the ovary and fruit. Occasionally there is a slight evidence of pubescence at the very base of the style. This variation is not unusual in any species of *Adinandra* where there is a pubescent ovary and glabrous style. However, seldom is this variation found within the species. Hayata describes the stamens as " $\infty$ , saepius 15-17" in number. I found the number to be about 25, the same as in the species.

Authentic specimens of *A. hypochlora* Hayata and *A. pedunculata* Hayata have not been examined. Kanehira, in his revised edition of Formosan Trees (1936), lists the two as synonyms of *A. formosana*. The early descriptions, such as they are, seem to bear out this transfer by Kanehira.

1b. *Adinandra Millettii* (Hooker & Arnott) Benth. & Hooker f. var. *obtusissima*, var. nov.

A typo differt bracteolis persistentibus, oppositis (linearibus, circiter 2  $\times$  1 mm.); foliis obovatis, basi longo-attenuatis; stylo pubescente.

DISTRIBUTION: Formosa.

FORMOSA: South Cape, *A. Henry* 1985 (NY).

This variety differs from the species in (1) the obovate leaves tapering

from the middle to the base; (2) the linear bracteoles (ca.  $2 \times 1$  mm.), persistent even on the fruiting specimen; (3) the pubescent style.

Matsumura and Hayata in 1906 listed an unnamed var. of *A. Millettii* collected by Henry on South Cape. The more definite locality of "Tamsui" was added in the citation. Probably these specimens are the same. Tamsui is not truly on South Cape but in the southern portion of Formosa, close to Ariko-banti, Ako, and Mt. Daizyurin, Takao, the type-localities of *Adinandra obtusissima*. As mentioned under *A. obtusissima* in this paper, I feel that a very close relationship exists between this variety and the species of the same name. The varietal name *obtusissima* was selected deliberately with this in mind.

2. *Adinandra Bockiana* Pritzl ex Diels in Bot. Jahrb. 29: 474 (Fl. Centr.-China). 1900. — Melchior in Nat. Pflanzenfam. ed. 2, 21: 145. 1925. — Metcalf in Lingnan Sci. Jour. 11: 20. 1932. — Chun in Sunyatsenia 4: 189. 1940.

DISTRIBUTION: China (Kwangsi, Kweichow, Szechuan).

KWANGSI: San Chiang Hsien, Ling Wang Shan, valley roadside, alt. 2100 m., *A. N. Steward & H. C. Cheo* 964 (A, NY), Sept. 17, 1933 (shrub 2.5 m. high with black fruit). — N. Luchen, Chu Feng Shan, 30 li southwest of Shan Fang, in open woods, alt. 1000 m., *R. C. Ching* 5838 (NY), June 8, 1928. KWEICHOW: Kiensi, Lung-kai-ching, open hillside, *Y. Tsiang* 8778 (A, NY), Aug. 29, 1930 (small tree 3 m. high; leaves green above, light green below). — Yao Shan, in mixed woods, *C. Wang* 40107 (A), Oct. 14, 1936 (tree 20 m. high; fruit black when ripe). — Tsunyi Hsien, Liang Feng Yah, shaded forest slope, *A. N. Steward, C. Y. Chiao & H. C. Cheo* 149 (A, C, NY, US), Aug. 31, 1931 (shrub 2 m. high with leaves dark glossy green above). SZECHUAN: Nan ch'uen, Tu ma ton, *C. Bock & A. von Rosthorn* 317 (TYPE, fragment and photo, A).

Shrub or small tree; branchlets terete, brown, glabrous or glabrescent, the very young branchlets densely reddish tawny-sericeous. Leaves coriaceous, oblong-ovate, 10–14 cm. long, 3–4.5 cm. wide, acuminate at the apex, the acumen 1–2 cm. long, acute at the base, the terminal buds and very young leaves densely reddish tawny-sericeous, the mature leaves deep dark glossy green, glabrous above, paler beneath covered with a soft tawny pubescence of varying density concentrated on midrib and the margin, the margin entire, lightly revolute, the veins ca. 12 pairs, obvious but not conspicuous, the petiole 5–7 mm. long, densely sericeous. Flowers axillary, solitary; pedicel slender, arching, 1–2 cm. long, densely spreading-pilose; bracteoles 2, opposite, immediately below the calyx-lobes, quickly caducous, when (rarely) present linear, ca. 4 mm. long, 1.5 mm. wide, densely pilose; calyx-lobes 5, imbricate, thin with little differentiation between the middle portion and the margin, subequal, ca. 6–6.5 mm. long, 3.5–4 mm. wide, the outer lobes broadly ovate, occasionally apiculate at the apex, the inner lobes more rounded at the apex, the margin glandular-denticulate and ciliate; mature corolla and stamens not seen; ovary globose, sparsely sericeous-pubescent, 3-celled, multi-ovulate, the style entire, glabrous, ca. 9 mm. long (post anthesis). Fruit globose, glabrescent, black, ca. 1 cm. in diameter; seeds many, reddish brown, shining.

In all the specimens examined, none had fully developed flowers for dissection. However, *Ching* 5838, in bud, upon dissection showed the corolla to be pubescent on the exterior surface. Otherwise, it appeared very similar to that of *A. Millettii*. The stamens, although minute, were 25 in number, uniserial, lightly adnate to the base of the corolla; the



filaments were glabrous, small and free from each other; the anthers broad and densely pilose. In fact, they appeared like those of *A. Millettii* in miniature.

*Adinandra Bockiana* differs from *A. Millettii* in: (1) the pubescent exterior surface of the corolla; (2) the calyx-lobes of *A. Bockiana* are more rotund at the apex with the maximum width considerably above the base; and (3) the dense, tawny pubescence of the branchlets, leaves and floral parts.

Further collections may prove this species to be worthy of varietal status only. It is confined to the provinces of western China, only one collection of *A. Millettii* having been made so far from Kwangsi.

2a. *Adinandra Bockiana* Pritzl ex Diels var. *acutifolia* (Hand.-Mazz.), comb. nov.

*Adinandra acutifolia* Handel-Mazzetti in Anz. Akad. Wiss. Wien 59: 105 (Pl. Nov.

Sin. Forts. 16, p. 5). 1922. — Melchior in Nat. Pflanzenfam. ed. 2, 21: 144. 1925.

— Metcalf in Lingnan Sci. Jour. 11: 20. 1932. — Chun in Sunyatsenia 1: 297. 1934.

DISTRIBUTION: China (Fukien, Hunan, Kweichow, Kwangsi).

FUKIEN: Yenping, Buong Kang, in bamboo forest, alt. 1000 m., *H. H. Chung* 3649 (A, M), July 2, 1925 (tree 10 m.). HUNAN: Near city of Wukang, on Yün-shan Mt. in deep forest, alt. 1170 m., *H. Handel-Mazzetti* 12350 (ISO-SYNTYPE, A), July 29, 1918 (shrub 2 m. with yellow flowers). — Sinning Hsien, Ma-Ling-Tung, under shade on slope, alt. 640 m., *C. S. Fan & Y. Y. Li* 516 (A), Sept. 21, 1935 (tree 10 m. high with dark purple fruit). KWEICHOW: In dumetis ad pagum Badschai, alt. 950 m., *H. Handel-Mazzetti* 10759 (ISO-SYNTYPE, A), July 14, 1917 (frutex elatus, fl. albis). — Tan ling, Tuhshan, in light shade, *Y. Tsiang* 6893 (A, NY), Sept. 5, 1930 (tree 4 m. high; leaves deep lustrous green above, lighter below). — Kweiting, along river, in open, alt. 400–550 m., *Y. Tsiang* 5464 (A, NY), June 30, 1930 (shrub; leaves deep green above, lighter below). — Yao-ren-shan, San hoa, in light woods, alt. 400–700 m., *Y. Tsiang* 6394 (A, NY), Aug. 10, 1930 (common tree 3–10 m.; leaves deep lustrous green above, lighter below). KWANGSI: Shang-sze Distr., Shap Man Cha Muk, near Hoh Lung village, southeast of Shang-sze (Kwangtung border), Wong Pan Cha Muk, in dry, clay thickets, *W. T. Tsang* 22486 (A), July 17, 1933 (tree 3 m. tall with edible black fruit). — Shang-sze Distr. (Kwangtung border), southeast of Shang-sze, Shap Man Taai Shan, Tang Lung village, Wong Pan Cha Shue, in swamp thickets, *W. T. Tsang* 24013 (A, M, NY), Aug. 11, 1934 (common, 2 m. high; fruit black, edible). — Shang-sze Distr., southeast of Shang-sze (Kwangtung border), near Iu Shan village, Wong Pan Cha Shue, in dry silt, sandy soil, *W. T. Tsang* 22167 (A), April 29–30, 1933 (scattered shrubs 2 m. tall; flowers yellow). — Kwei-lin Distr., Hsi-chang village and vicinity, Ch'i-fen-shan, Wong Pan Cha Shue, in thickets on steep slope, *W. T. Tsang* 28485 (A, US), Oct. 1–11, 1937 (fairly common, 2 m. high; fruit edible, black).

ADDED DESCRIPTION: Flowers axillary, solitary or rarely in twos; pedicel usually recurved, ca. 1 cm. long, lightly strigillose or glabrescent; bracteoles 2, quickly caducous, when present linear-oblong, ca. 2 mm. long and 1 mm. wide, slightly pubescent; calyx-lobes 5, imbricate, broadly ovate, subequal, 4–5 mm. long, 3–3.5 mm. wide, glabrescent or glabrous, the outer lobes somewhat acuminate, the inner lobes more rounded at the apex, the margin glandular and ciliate-fimbriate; corolla-lobes 5, connate at the base, ca. 7 mm. long, 4.5–5 mm. wide, rounded at the apex, pubescent on the median portion of the exterior surface; stamens ca. 25, uniseriate, ca. 5 mm. long, the filaments lightly adnate to the base of the corolla, free from each other, glabrous, ca. 2 mm. long, somewhat dilated in the middle,

the anthers ca. 2 mm. long, quite wide at the base, somewhat sagittate, densely hirsute, the apicule ca. 1 mm. long; ovary subglobose, white-sericeous, 3-celled, multi-ovulate, the style ca. 8 mm. long, glabrous, entire. Fruit globose, dark purple when ripe, soft, thin-walled, ovoid, ca. 1 cm. or more in diameter, many-seeded; the seeds dark, shining.

This variety agrees with the species in most characters. The chief feature of separation is the glabrescent or glabrous character of most of its parts.

2b. *Adinandra Bockiana* Pritzl ex Diels var. *tonkinensis*, var. nov.

*Adinandra Millettii* Merrill in Jour. Arnold Arb. 19: 55. 1938. — Gagnepain in Fl. Gén. Indo-Chine, Suppl. 1: 284. 1943. Non (Hooker & Arnott) Benth. & Hooker f.

A typo differt gemmis, juventutibus ramulis, pedicellis, bracteolis, calycibus pubescentibus adpressis.

DISTRIBUTION: Indo-China (Tonkin).

TONKIN: Chapa, on banks of brooks and ravines, alt. 1500 m., *A. Pételot* 3751 (TYPE, NY, US), July 1930 (tree 10 m. high with very pale salmon-colored corolla). — Station du Tam Dao, alt. 900 m., *A. Pételot* 3976 (NY, US), May 1931. — Chapa, alt. 1500 m., *A. Pételot* 4308 (NY, US), July 1931.

Both Merrill and Gagnepain associated the specimens cited above with *A. Millettii*. However, the acuminate leaves, the broadly ovate calyx-lobes and the pubescent corolla-lobes show it to be a variation of *A. Bockiana* and closely allied to *A. Bockiana* var. *acutifolia*. The real difference lies in the pubescence. Whereas, in *A. Bockiana* and *A. Bockiana* var. *acutifolia* the pubescence is spreading, in this variety the pubescence is short and closely appressed.

3. *Adinandra megaphylla* Hu in Bull. Fan. Mem. Inst. Biol. 6: 172. 1935; in Icon. Pl. Sin. 5: 1, t. 201. 1937.

*Adinandra Petelotii* Gagnepain in Not. Syst. Mus. Hist. Nat. Paris 10: 115. 1942; in Fl. Gén. Indo-Chine Suppl. 1: 289. 1943.

*Adinandra serrulata* Li in Jour. Arnold Arb. 26: 66. 1945.

DISTRIBUTION: China (Yunnan, Kwangsi); Indo-China (Tonkin).

CHINA: YUNNAN: Ping-pien Hsien, in ravine, alt. 1200 m., *H. T. Tsai* 60288 (ISOTYPE, A), June 19, 1934 (small tree 7 m. high). KWANGSI: Chen Pien Distr. on slope in forest, *S. P. Ko* 55926 (A), Oct. 17, 1935 (tree 8 m. high; fruit deep red). — Ling Wan Distr. in light forest, *S. K. Lau* 28705 (TYPE of *A. serrulata*, A), July 19, 1937.

INDO-CHINA: TONKIN: near Chapa, alt. 1800 m., *A. Pételot* 3788 (ISOTYPE of *A. Petelotii*, A), Aug. 1930.

Small tree (6 m.); branchlets terete, ferruginous-pilose; terminal buds elongate-conical up to 2 cm. long, densely appressed ferruginous-sericeous. Leaves coriaceous, oblong-lanceolate, 16–24 cm. long, 4–7 cm. wide, acuminate at the apex, rounded to broadly cuneate at the base, the very young unfolding leaves densely ferruginous-pubescent, the mature leaves glabrous on the upper surface except within the channelled midrib, scattered-appressed-pilose beneath in varying degrees, occasionally quite glabrescent, the margin serrulate with occasional apiculate glands varying according to the age of the leaf, the veins ca. 20–24 pairs, slightly curved, arching, more prominent beneath, the reticulations obvious, the petiole



stout, ca. 12–15 cm. long, appressed-ferrugineous-pilose above and beneath. Flowers axillary, solitary; pedicel up to 3 cm. long, thickened at the apex, recurved, appressed-pilose; bracteoles 2, quickly caducous, alternate, when present oblong, acute at the apex, 5–6 mm. long, ca. 3 mm. wide, pilose; calyx-lobes 5, imbricate, thick, unequal, broadly ovate, outer lobes 11–13 cm. long, 10–11 cm. wide, sericeous on the median portion of the dorsal surface, the inner lobes pubescent, smaller, less thick, the margins more scarious; corolla-lobes (fide Hu) “5, unequal, broadly ovate-oblong, to 13 mm. long, 7 mm. broad, slightly grey-ferrugineous-sericeous outside, glabrous inside serrulate along the margins;” stamens 40–45, seemingly uniseriate, rather uniform in size, the filaments short, thickened, ca. 2 mm. long, glabrous, the anthers ca. 4 mm. long, densely sericeous on the dorsal surface, apiculate; ovary conical, densely sericeous, 5-celled, multi-ovulate, tapering at the apex into the short blunt style which is appressed-pubescent, the pubescence thinning out towards the glabrous apex. Mature fruit not seen, maturing fruit very thick-walled.

There are several very obvious characteristics which aid in easily distinguishing this species. First, the large, oblong-lanceolate leaves 20–24 cm. long and definitely serrate; second, the large almost velvety calyx-lobes, similar in size and appearance to those of *A. glischroloma* var. *macrosepala* (Metcalf) Kob.; and third, the pubescence along the midrib of the upper surface of the leaf.

Gagnepain described the same species under the name *A. Petelotii*. There is no need for discussion because the two are obviously the same. Li's species, *A. serrulata*, was described from specimens with leaves somewhat smaller (16–20 × 4–5 cm.), but otherwise matching those of *A. megaphylla* perfectly.

Hu's original description is excellent and very detailed. He states, however, that the stamens are glabrous. Although only buds were available for dissection in this study, it is clear from these dissections that the stamens are very hirsute along the dorsal surface of the anther. Also Hu gives the impression from his description and later drawings in Icon. Pl. Sin. that the bracteoles are persistent, whereas in the two specimens examined they are obviously quickly caducous. He fails to mention that the ovary and style are pubescent and that the ovary is five-celled. His later illustration, however, depicts pubescence on these parts.

4. *Adinandra glischroloma* Handel-Mazzetti in Anz. Akad. Wiss. Wien 60: 96 (Pl. Nov. Sin. Forts. 16, p. 5). 1923. — Melchior in Nat. Pflanzenfam. ed. 2, 21: 145. 1925. — Merrill in Lingnan Sci. Jour. 7: 315. [1929] 1931. — Metcalf in Lingnan Sci. Jour. 11: 20. 1932.

*Adinandra chinensis* Merrill ex Metcalf, loc. cit., nomen.

DISTRIBUTION: China (Kwangtung, Kwangsi).

KWANGTUNG: Lochang Distr., Sei Hsien, *C. L. Tso* 20328 (A, NY), May 9, 1929. — Canton, near town of Lien ping, alt. 500–900 m., *R. Mell* 679 (ISO-SYNTYPE, A), Aug. 11, 1920 (very abundant). — Lung T'au Mt., near village of Iu, in ravine on side of mountain, *K. P. To & U. K. Ts'ang* 12041 (M, US), May 23, 1924 (tree 2 m. high; flowers red and white). — Sing-fung Distr., Hau T'ong Shan, Fuk Lung Monastery, in thickets, *Y. W. Taam* 758 (A), May–June 1938 (scattered shrubs with black edible fruit). — Mei Distr. (Kaying), Yam Na Shan (Yit Nga Shan), in dry silt, *W. T. Tsang* 21387 (A, NY), Aug. 1932 (scattered shrubs ca. 3 m. tall; fruit black).

KWANGSI: Yuan Tang Shan, 15 li west of Shan Fang, N. Luchen, in forest, alt. 600 m., *R. C. Ching* 5719 (A, NY), June 6, 1928 (shrub 2 m. high; leaves dark green above, paler below).—Yao Shan, in mixed woods, *C. Wang* 39479 (A), 40155 (A), 40161 (A), June-Oct. 1936 (tree 10–15 m. high; fruit black).

Shrub or small tree; branchlets thick, terete, villous-pubescent, the young branchlets and terminal buds covered with a brown, more dense villous pubescence. Leaves coriaceous, oblong-elliptic, 8–14 cm. long, 3–5 cm. wide, acuminate at the apex, tapering at the base, usually cuneate, occasionally somewhat rounded, glabrous above, tawny-hirsute beneath, more densely concentrated along the margin and the midrib, the margin revolute, usually entire with occasional apiculate glands, the concentrated pubescence (extending from beneath) appearing as a halo along the edge of the upper surface, the veins 10–12 pairs, conspicuous on both surfaces, the petiole 8–10 mm. long, densely hirsute. Flowers axillary, in twos or threes, rarely solitary; pedicel 6–15 mm. long, erect or recurved, tawny-brown-hirtellous; bracteoles 2, caducous, opposite or alternate; calyx-lobes 5, imbricate, broadly ovate, 6–7 mm. long, hirtellous; corolla and stamens not seen; immature capsule 5-celled, hirtellous, the style ca. 1 cm. long, the lower two-thirds hirtellous, the upper third glabrous.

The tawny-hirtellous pubescence of the young branchlets, the under surface of the leaves and the flowering parts make this species and its varieties easily distinguishable. Concentrated along the margin, even when the leaf has become glabrescent, this pubescence projects beyond the edge of the lower surface in such quantity and to such an extent that when viewed from the upper surface it presents the appearance of a tawny halo. The species is unique in this character. Another unusual feature, for Chinese species, is the occurrence of the axillary flowers in twos and threes; only occasionally does one find solitary flowers. All material cited above is either in bud or in the post anthesis stage. Dissections of very young buds do show, even so, that the corolla-lobes are pubescent on the median portion of the external surface and are somewhat ovate in shape. The stamens, although they appear to be in series and over 30 in number, are quite uniform in size. The filaments are glabrous and the anthers hirsute.

In *Tsang* 21387, the only specimen with developing fruit, the calyx-lobes measure close to 10 mm. in length and 5–6 mm. in width.

Cited here as a synonym is the herbarium name *A. chinensis* Merrill. Metcalf (Lingnan Sci. Jour. 11: 20, 1932) mentioned this unpublished species and listed it as a synonym of his own *A. macrosepala*. Examination of Merrill's specimens shows that Merrill had designated as the type of his unpublished species Wulsin's (Canton Christian College 12041) specimen and not *Chung* 3384, which belongs to the variety *macrosepala*.

4a. *Adinandra glischroloma* Handel-Mazzetti var. *macrosepala* (Metcalf), comb. nov.  
*Adinandra macrosepala* Metcalf in Lingnan Sci. Jour. 11: 18, 1932.

DISTRIBUTION: China (Fukien, Chekiang).

FUKIEN: Yenping, Buông Kang, in thickets, alt. 800 m., *H. H. Chung* 3384 (SYNTYPE of *A. macrosepala*, A, ISO-SYNTYPE M), June 14, 1925 (shrub 3 m.).—Chung an Hsien, open hillside, alt. 1100 m., *H. H. Hu* 1322 (SYNTYPE of *A. macrosepala*, A) July 23, 1921 (shrub ca. 1 m.).—No data, *H. H. Chung* 7369 (A).



CHEKIANG: , 80 li northeast of Tai Suan, in open thickets, alt. 800 m., *R. C. Ching* 2183 (A, NY, US), July 20, 1924 (shrub 5 m. high with brownish bark).—Taishun Hsien, on mountain slope, *Y. L. Keng* 312 (A), Aug. 5, 1926 (shrub 1–2 m.).

The chief difference of this variety from the species is found in the size of the calyx-lobes. Whereas, in the species, in bud, the lobes measure 6–7 mm. in length and in a single early fruiting specimen the calyx-lobes measure 9–10 mm.  $\times$  5–6 mm., in the variety, the calyx-lobes in bud measure 11–14 mm. in length. Their full development is not known.

Dissections of flowers in bud, more nearly mature than those in the species, show that, like the species, their corolla-lobes are ovate, acute at the apex, and pubescent on the dorsal surface. The stamens, many in number, appear to be seriate. The anthers are quite uniform and measure ca. 3 mm. in length. The filaments are very short and glabrous, while the apicule varies considerably in length, from 1–2–3 mm.

One may assume that, when mature flowers of the species and variety are collected, all the floral parts of the variety will be uniformly larger than those of the species.

4b. *Adinandra glischroloma* Handel-Mazzetti var. *jubata* (Li), comb. nov.

*Adinandra jubata* Li in Jour. Arnold Arb. 25: 422. 1944.

DISTRIBUTION: China (Kwangtung).

KWANGTUNG: Hwei-yang Distr., Shek Shing village, Lin Fa Shan, *W. T. Tsang* 25601 (TYPE of *A. jubata*, A), Aug. 25–26, 1935 (scattered shrubs 2 m. high; fruit edible, black).

This variety is characterized by a beautiful, dense, ferrugineous, iridescent tomentum (sometimes as much as 5 mm. long) on the terminal buds, young branchlets, under surface of the leaves, and flowering parts. Li separated it from *A. glischroloma* Handel-Mazzetti but it appears to be nearer the variety var. *macrosepala* and except for degree of pubescence is a perfect match for *Chung* 7369 collected in Fukien.

In reality, except for pubescence, this variety seems to be midway between the species and the variety *macrosepala*. In the two latter entities the pubescence is very similar. However, they both agree with var. *jubata* in type of pubescence differing only in density.

4c. *Adinandra glischroloma* Handel-Mazzetti var. *hirta* (Gagnepain), comb. nov.

*Adinandra hirta* Gagnepain in Not. Syst. Mus. Hist. Nat. Paris 10: 113. 1942; in Fl. Gén. Indo-Chine, Suppl. 1: 286, fig. 26. 1943.

DISTRIBUTION: Indo-China (Tonkin).

TONKIN: Chapa, alt. 1500 m., *A. Pételot* 3818 (ISOTYPE of *A. hirta*, A, US), Aug. 1930.

This variety agrees with *A. glischroloma* Handel-Mazzetti in most characteristics. The flowers are axillary and like the species are in pairs, or in threes, rather than solitary. The buds are small and very hirsute. The pubescence of the leaves, although of the same type, is less dense. However, in the very young leaves, the pubescence appears more dense and typical of the species.

The characteristics which separate var. *hirta* from the species, although

of dubious importance, are: (1) the ovate-acute or deltoid, persistent bracteoles; (2) the style, pubescent its entire length; and (3) the pubescent filaments.

5. *Adinandra filipes* Merrill in herb., sp. nov.

Frutex 4 m. altus, subglaber (floribus ignotis), ramis ramulisque teretibus, ramulis ultimis 2 mm. diametro, adpresso-pubescentibus; gemmis leviter adpresso-pubescentibus; foliis coriaceis, oblongo-ellipticis, 7–10 cm. longis, 2–2.5 cm. latis, apice graciliter acuminatis, basi cuneatis, glabris, haud punctatis, margine minute apiculato-serrulatis, dentibus inter se 2–3 mm. distantibus, deorsum remotioribus, margine in partibus inferioribus integris vel subintegris, nervis primariis utrinque 12–15, gracilibus haud perspicuis, arcuato-anastomosantibus; petiolo crasso, circiter 2 mm. longo; fructibus solitariis, axillaribus, longe (4 cm.) graciliterque pedicellatis, ovoideis, circiter 1 cm. longis (immaturis) conperse pubescentibus, stylis gracilibus, circiter 1 cm. longis, breviter ciliato-pubescentibus, apice breve tripartitis; bracteolis 2, caducis; sepalis 5, imbricatis, persistentibus, reflexis, oblongo-ovatis, circiter 8 mm. longis, acutis, obscurissime adpresso-pubescentibus.

DISTRIBUTION: China (Kwangsi).

KWANGSI: Yeo Mor Shan, N. Lin Yen, rare in forest, alt. 1400 m., *R. C. Ching* 7138 (TYPE, NY, tracing, A), Aug. 25, 1928 (shrub 3 m. high with gray bark; leaves deep shining green above, pale beneath).

This species, considered rare by the collector, is characterized by the slender, elongated pedicels which in fruit are 4 cm. in length, by the reflexed sepals, and the three-parted, pubescent style.

6. *Adinandra hainanensis* Hayata, Icon. Pl. Formos. 3: 43. 1913. — Melchior in Nat. Pflanzenfam. ed. 2, 21: 144. 1925. — Merrill in Lingnan Sci. Jour. 6: 283. 1930. — Tanaka & Odashima in Jour. Soc. Trop. Agric. 10: 375. 1931. — Metcalf in Lingnan Sci. Jour. 11: 20. 1932.

*Adinandra hainanensis* Merrill in Philip. Jour. Sci. 23: 259. 1923.

*Adinandra Maclurei* Merrill in Lingnan Sci. Jour. 5: 129. 1927.

*Adinandra rubropunctata* Merrill & Chun in Sunyatsenia 1: 70. 1930. — Metcalf in Lingnan Sci. Jour. 11: 20. 1932. — Merrill & Chun in Sunyatsenia 2: 41. 1934. — Chun, Icon. Pl. Sin. 5: 3, t. 203. 1937; in Sunyatsenia 4: 188. 1940.

DISTRIBUTION: China (Hainan, Kwangtung).

HAINAN: Ch'and-kiang Distr., Ka Chik Shan and vicinity, in thickets on dry cliffs, *S. K. Lau* 1486 (A, NY), 1533 (A, NY), April 8–13, 1933 (tree 3–4 m. high, 9–12 cm. diam.). — Lam Ko Distr., Fu Hoi and vicinity, *W. T. Tsang* 201 (A, M, NY, US), July 29, 1927 (4 m. high). — Taam Chau Distr., Sha Po Shan, in forest, *W. T. Tsang* 543 (A, NY, US), May 27, 1928 (flowers white). — Lam Ko-Chung Mai Districts, Taai Wong Shan, summit of mountain, *W. T. Tsang* 711 (A, US), June 15, 1928 (2 m. high; flowers white). — Dung Ka to Wen Fa Shi, in thickets, alt. 550 m., *N. K. Chun & C. L. Tso* 43778 (A, NY), Sept. 1, 1932 (tree 6 m. high, 10 cm. diam. with smooth gray branches and brownish gray branchlets; leaves dark green glabrous above, paler pubescent beneath). — Dung Ka, in forested ravine, alt. 800 m., *N. K. Chun & C. L. Tso* 43936 (A, NY), Sept. 25, 1932 (tree 8 m. high with gray bark and branchlets; leaves lustrous dark green above, paler beneath). — Ng Chi Ling, Fan Yah, in thin forest, alt. 300 m., *N. K. Chun & C. L. Tso* 44012 (A, C, NY), Oct. 5, 1932 (tree 8 m. high, 20 cm. diam. with gray bark; leaves deep green above). — Po-ting, in forest ravine, alt. 300 m., *F. C. How* 72081 (A), April 23, 1935 (tree 7 m. high with gray bark; leaves lustrous green above, paler beneath). — Tai Pin, *J. L. Gressitt* 1076



(A), June 21, 1935 (tree 10 m. high, 15 cm. diam.). — Five Finger Mt., in wooded ravine, *F. A. McClure 9571* (A, M), May 13, 1922 (shrub 3 m. high, 8 cm. diam.). — Ching Mai Distr., Tai Wong Ling and vicinity, Tung Pin Tin village, dry sandy slope in thicket, *C. I. Lei 816* (A, NY, US), July 5, 1933. — Hung Mo Shan and vicinity, by stream, *Tsang & Fung 292* (A, NY, US), June 13, 1929 (fruit black). — Seven Finger Mt., in thicket on slope, *H. Y. Liang 61760* (A, NY, US), May 6, 1930 (tree 7 m. high with gray bark and branches). — Ngai Distr., Yeung Ling Shan, in thickets on moist clay slope, *S. K. Lau 196* (A, M, NY, US), July 2, 1932. — Bak Sa, in thickets, *S. K. Lau 26138* (A), April 8, 1936. — Loktung, in dense woods, *S. K. Lau 27209* (A), June 20, 1936. — Po-ting, in forested ravine, alt. 400 m., *F. C. How 72471, 73514* (A), May-Aug. 1935 (tree 9–25 m. high; flowers white). — Exact locality lacking, in mixed forest, *C. Wang 33649* (A, NY), Aug. 12, 1933 (tree 10 m. high). KWANGTUNG: Ta Mien Shan, Sup Man Ta Shan, in shaded woods, *H. Y. Liang 69638* (A), *69640* (A), July 14, 1937 (tree 6 m. high; fruit villous). — Weishang, Sunyi, in light shade, alt. 930 m., *Y. Tsiang 2713* (TYPE of *A. rubropunctata*, NY), June 15, 1929 (tree 7 m. high; leaves lustrous green above, light green beneath).

Shrub or small tree up to 10 m., rarely up to 25 m.; branches brown or grayish brown, terete, the very young branchlets and terminal buds appressed-pubescent. Leaves coriaceous, oblong-elliptic to oblong-obovate, 6–8 × 2–3 cm. and 10–13 × 5–6 cm., shortly acuminate at the apex, acute at the base, shining green above, paler beneath, glabrous on both surfaces, conspicuously dark-punctate beneath, the margin distinctly glandular-denticulate, the veins ca. 12 pairs, distinct on both surfaces, reticulate, the petiole ca. 5 mm. long, on larger leaves up to 10 mm. Flowers axillary, solitary; pedicel ca. 7 mm. long, strongly recurved, generally glabrous or glabrescent, those of the very young flowers appressed-pubescent especially at the very tip of the branchlets; bracteoles 2, opposite, quickly caducous, when present pubescent, unequal, ca. 3 × 1.5 mm. and 5 × 3 mm.; calyx-lobes 5, imbricate, densely tawny-sericeous-pubescent, subequal, 6–8 mm. long, ca. 6 mm. wide, ovate, sometimes subrotund at the apex, outer lobes thicker, glandular-denticulate along the scarious margin, the inner lobes thinner, the margin usually entire; corolla-lobes 5, connate at the base, white, pubescent on the median portion of the exterior surface, oblong-subelliptic, 7–8 mm. long, ca. 4 mm. wide, somewhat obtuse at the apex; stamens 30–35, seemingly uniseriate, rather uniform in size, 5.5–7 mm. long, the filaments 2–3 mm. long, glabrous, quite free from each other, adnate to the base of the corolla, projected at the apex into an apicule ca. 1 mm. long, the anthers ca. 3 mm. long, linear, pubescent; ovary minute, densely covered with whitish or tawny pubescence, 5-celled, multi-ovulate, tapering into a densely pubescent style 6–7 mm. long. Fruit globose, black, pubescent, 5-celled, many-seeded, 1–2 cm. diameter.

The outstanding characteristics of this species are: (1) the 5-celled ovary; (2) the dense tawny pubescence on the floral parts; (3) the distinct reticulate veining obvious on both surfaces and the dark-punctate dots on the lower surface of the leaves; (4) the short, recurved pedicel; and (5) the glandular-denticulate margin of the leaves.

Its closest relative is *A. lasiostyla* Hayata, which can be separated by the 3-celled ovary, the obscure veining, the usually entire margin, and the scattered pubescence on the lower half of the style.

Several synonyms are cited above, only one of which, *A. rubropunctata*

Merrill & Chun, needs comment. In 1940, Chun (Sunyatsenia 4: 188) listed seven specimens from Hainan as belonging to *A. rubropunctata*. Of these, I have examined *S. K. Lau* 196, *H. Y. Liang* 61760, *F. C. How* 72471 and 73514. I can find no characters in these specimens that would warrant separation from the above species. Metcalf (1932) separates *A. rubropunctata* from *A. hainanensis* on the presence of red-punctate dots on the lower surface of the leaf, and the apiculate denticulations along the margin. The original description stressed these two characters. Examining considerable material, one finds great variation in the color of the punctate dots which range from black through brown to reddish brown, even to a lighter yellowish shade. This color variation is undoubtedly due to the age of the leaf. The apiculate denticulations may be found on nearly every leaf, varying in size and number. Age probably governs this characteristic also, as these apiculations are very fragile and are easily broken off.

The type specimen of *A. rubropunctata*, *Tsiang* 2713, offers the only variation worthy of consideration. Whereas in most of the specimens cited above the pubescence is tawny or straw-colored, in the above-mentioned type the pubescence is more dense and ferrugineous. The pedicels of *Tsiang* 2713 are densely pubescent. As it happens, all the flowers of *Tsiang* 2713 are concentrated at or near the apex of the young branchlets, so near as still to possess the pubescence found on the early growing parts. In the other specimens examined the flowers are scattered along the stems, and the pedicels are usually glabrous or only slightly pubescent. In *Tsiang* 2713, the bracteoles are consistently persistent. In the other specimens of *A. hainanensis*, the bracteoles are quickly caducous, but when present, are of the same size and shape as those found on the above-mentioned *Tsiang* specimen.

7. *Adinandra lasiostyla* Hayata in Jour. Coll. Sci. Tokyo 30 (Art. 1): 42. 1911. — Kanehira, Formosan Trees 53, fig. 1917; revised ed. 453, fig. 410. 1936. — Melchior in Nat. Pflanzenfam. ed. 2, 21: 145. 1925. — Sasaki, Cat. Governm. Herb. 347. 1930.

DISTRIBUTION: Formosa.

FORMOSA: Arisan, *R. Kanehira* 2842 (NY, US), Dec. 1, 1933. — Arisan Prov., Kagi, in forest, alt. 1600–2800 m., *E. H. Wilson* 9667, 9770, 10819 (A, US), Jan. 29, Feb. 4, Oct. 18, 1918 (tree 10–15 m. high).

Trees 8–15 m. high, 1–1.5 m. circumference; branches terete, brown to grayish brown, the branchlets and terminal buds tawny-pubescent. Leaves coriaceous, oblong-elliptic, 8–13 cm. long 2–4 cm. wide, acuminate at the apex, acute at the base, shining glabrous above, pubescent beneath, the margin entire or obscurely crenulate, the veins ca. 12 pairs, obscure above, somewhat conspicuous beneath, the petiole short, 3–5 mm. long, pubescent beneath. Flowers axillary, solitary; pedicels pubescent, short, recurved, ca. 5 mm. long; bracteoles 2, quickly caducous; calyx-lobes 5, imbricate, subequal, rounded, ca. 6 mm. long, 5 mm. wide, pubescent, glandular-denticulate along the margin; corolla-lobes 5, lightly connate at the base, ca. 9 mm. long, 5 mm. wide, broadly acute or obtuse at the apex, pubescent along the median portion of the exterior surface; stamens 20–25,



seemingly uniseriate, rather uniform in size, 5–5.5 mm. long, the filaments glabrous, 1.5–2 mm. long, quite free from each other but adnate to the base of the corolla, the anthers ca. 2.5 mm. long with dense tawny pubescence, the apicule distinct 1–1.5 mm. long; ovary subglobose, tapering slightly at the apex, scattered pubescent, 3-celled, multi-ovulate; style entire, up to 10 mm. long, 1–1.5 mm. in diameter near the base, sparingly pubescent along the lower half; stigma obtuse. Fruit immature.

This species is closely related to *A. Millettii* (Hooker & Arnott) Benth. & Hook. f. and perhaps belongs to the same alliance of species. Certain consistently uniform characteristics, however, are present to warrant specific separation. The large pubescent acuminate leaves resemble those of *A. Bockiana* Pritzl and its variety *acutifolia* (Hand.-Mazz.) Kob.

A dense pubescence covers the young branchlets, lower leaf-surface, pedicels and calyx-lobes. Oddly enough, the style (whence the specific name) is only slightly pubescent with the scattered pubescence extending only along the lower half.

The pedicel is very brief, not more than 5 mm. long, and always recurved. The calyx-lobes are rounded rather than acute and the exterior surface of the corolla-lobes is pubescent.

Whereas *A. Millettii* is considered a shrub and rarely a small tree, this species is definitely a tree of considerable magnitude according to Wilson, measuring "30–50 ft.  $\times$  2–5 ft." I presume the latter measure is circumference. Wilson states that the species is very common at Arisan. All specimens examined by the author were collected from this locality or nearby Mt. Morrison. All other specimens cited in literature have been collected in the same general limited locality.

8. *Adinandra epunctata* Merrill & Chun ex Tanaka & Odashima in Jour. Soc. Trop. Agric. 10: 374. 1931, nomen; Merrill & Chun in Sunyatsenia 5: 132, fig. 14. 1940.

DISTRIBUTION: China (Hainan).

HAINAN: Mo San Leng, in forest, alt. 1300 m., *N. K. Chun & C. L. Tso 44289* (A, C, NY, US), Nov. 20, 1932 (tree 12 m. high with grayish brown bark and gray branchlets; leaves deep lustrous green; flowers white).—In mixed forest, *C. Wang 35912* (TYPE A, ISOTYPES NY, US), Dec. 18, 1933 (tree 18 m. high with gray branches; leaves green above, paler green and tomentose beneath; flowers yellowish white).—In mixed forest, *C. Wang 36007* (A, NY, US), Dec. 30, 1933 (tree 12 m. high with white flowers).—In shaded forest on mountain side, *H. Y. Liang 64384* (NY), Jan. 10, 1934 (tree 12 m. high, 1 m. diam.; leaves thick, green above, paler beneath).

Small tree 12–18 m. high; branches terete, glabrous, gray or brown-gray, the branchlets terete, gray or gray-brown, finely appressed-pale- to ferrugineous-pubescent, the terminal buds conical, covered with a very dense tawny to ferrugineous velvety pilose pubescence. Leaves coriaceous, elliptic-oblong, 5–11 cm. long, 2–4 cm. wide, acute at both the apex and the base, lustrous, deep green, glabrous above, paler, at first densely appressed-pubescent beneath, later glabrescent or nearly so, entire along the margin, the veins 12–15 pairs, arching upward near the margin, quite prominent above, less so beneath, the petiole 8–15 mm. long, appressed-pubescent. Flowers axillary, solitary, occasionally in twos; pedicels up to 7 mm. long, densely pubescent, usually somewhat recurved; bracteoles 2, opposite, persistent, sepaloid, long-triangular, ca. 3 mm. long, 1.75–2

mm. wide, acute at the apex, densely pubescent; calyx-lobes 5, imbricate, ovate, acute at the apex, ca. 5 mm. long, 2.5–3 mm. wide, entire, densely appressed-pale-pubescent; corolla-lobes 5, white, lightly connate at the base, oblong, obtuse at the apex, 6–7 mm. long, 3–4 mm. wide, pubescent on the external surface, glabrous within; stamens 25, unequal, 4–6 mm. long (in the same flower), the filaments 2–4 mm. long, pubescent on the external surface except at the base where joined to the corolla, for the same distance joined to each other, the anthers lanceolate, nearly equal, 1.5–2.0 mm. long, pubescent; the apicule short, 0.5 mm. or less; ovary somewhat conic-ovoid, densely gray-pubescent, 3-celled, tapering at the apex into an entire, pubescent style ca. 3–4 mm. long. Fruit small, ovoid, ca. 5 mm. long, 4 mm. diam., densely pubescent, 3-celled, few-seeded, seeds 9–10, brown, scrobicular, ca. 2 mm. long.

A few of the outstanding characteristics of this species are the small flowers and fruit, the persistent and comparatively large bracteoles, the very short pedicels, the pubescent filaments of the anthers, the entire leaves, and the small number of seeds developing in the fruit.

Although not described until 1940, this species was mentioned in a list of the Hainan plants by Tanaka and Odashima in 1931, the name probably recorded from an herbarium sheet.

Merrill and Chun, in their description, do not mention the number of cells in the ovary and fruit but in the accompanying illustration the ovary is pictured as six-celled. Because of the minute size and dense pubescence, dissections of the ovary are very difficult and quite unsatisfactory. On the other hand, the fruit, when mature, is so crowded with the few seeds which are normal in size, even though the fruit is small, that dissections again are rather unsatisfactory. After several dissections, none of which showed clear-cut cell-structure, my conclusions are that the fruit is three-celled rather than six-celled. It may be that in the original drawing the placentae, which often extend nearly across the cell, were mistaken for cell-walls.

9. *Adinandra laotica* Gagnepain in Not. Syst. Mus. Hist. Nat. Paris 10: 114. 1942; in Fl. Gén. Indo-Chine, Suppl. 1: 283. 1943.

DISTRIBUTION: Indo-China (Laos).

LAOS: Hui-Muang-Ao, Xieng-khuang, by stream among evergreens, alt. up to 1100 m., *A. F. G. Kerr 21172* (ISOTYPE, K), April 21, 1932 (tree 15 m. high).

Tree 15 m. high; branchlets tawny brown, terete, glabrous; terminal buds large, glabrous. Leaves thick-coriaceous, glabrous, oblong-lanceolate, 15–20 cm. long, 5.5–6.5 cm. wide, shortly acuminate at the apex, tapering at the base, the margin entire, lightly revolute, the primary veins 12–15 pairs, anastomosing and arching upward near the margin, somewhat pronounced above, obscure beneath, frequent secondary veins interspersed between the primary veins, the petiole 15–20 mm. long, glabrous. Flowers axillary, in pairs; pedicel 2–2.5 cm. long, glabrous, thickening towards the apex; bracteoles 2, opposite or nearly so, quickly caducous; calyx-lobes 5, imbricate, broadly ovate,  $\pm$  8 mm. long, 6–7 mm. wide, glabrous, the margin ciliolate; corolla-lobes (in bud) 5, connate at the base, ca. 6 mm. long, glabrous; stamens (bud) ca. 25, 3?-seriate, 2–6 mm. long, the filaments



glabrous, the anthers pilose; ovary glabrous, quite flat in bud, 5-celled, multi-ovulate, the style entire, glabrous.

*Adinandra laotica* is in many respects a very close relative of *A. angulata* Ridley. Both species have thick branches and branchlets, terete in the former and decidedly angled in the latter. The leaves of both are stiff and heavy-coriaceous. The flowers are axillary and in pairs. In *A. angulata* the two pedicels remain attached at the base when removed from the stem and it appears that such may be the case in *A. laotica*. Both species are very glabrous, even to the terminal bud.

In *A. angulata*, the ovary and fruit are 3-celled with few ovules and later with only a few large seeds developing. Gagnepain describes the ovary of *A. laotica* as 4-celled. My single dissection showed the ovary to be clearly 5-celled. Only buds were available to both Gagnepain and myself, and in the bud, the ovary is very flat, thin and difficult to section. The bracteoles of *A. laotica* are caducous while in *A. angulata* they are persistent. Also, the veins of the leaves of *A. angulata* are less in number and much more prominent.

10. *Adinandra nitida* Merrill ex Li in Jour. Arnold Arb. 25: 422. 1944.

DISTRIBUTION: China (Kwangsi, Kwangtung).

KWANGSI: Shang-sze Distr., Shap Man Taai Shan, near Iu Shan village, southeast of Shang-sze, near the Kwangtung border, in dry sandy thickets, *W. T. Tsang* 22322 (TYPE, A), May 18, 1933 (4 m. high; flowers fragrant, white).—Shang-sze Distr., Shap Man Taai Shan, near Hoh Lung village, southeast of Shang-sze, near Kwangtung border, in thickets on dry steep rocky slope, *W. T. Tsang* 22571 (A), June 26, 1933 (fruit black).—Shang-sze Distr., Shap Man Taai Shan, Tang Lung village, southeast of Shang-sze, near Kwangtung border, *W. T. Tsang* 24431 (A, NY), Oct. 1934 (scattered shrubs 2 m. high; fruit yellow, edible).—N. Luchen, Chu Feng Shan, 30 li southwest of Shan Feng, in forest, alt. 800 m., *R. C. Ching* 5826 (NY), June 8, 1928 (tree 15 m. high, 30 cm. diam., with gray bark).—Kan-tung, Miu Shan, in forest, alt. 1000 m., *R. C. Ching* 6139 (NY), June 18, 1928 (tree 10 m. high, 15 cm. diam., with gray bark; leaves glossy green above, paler beneath; flowers creamy white, scented, nodding).—N. Luchen, In-tung, Miu Shan, near border of Kweichow, in woods, alt. 1000 m., *R. C. Ching* 6238 (NY), June 21, 1928 (shrub 6 m. high, 15 cm. diam.; leaves glossy dark green above, paler beneath; flowers creamy white, nodding).—South of Nanning, *R. C. Ching* 8431 (NY), Nov. 5, 1928 (tree 20 m. high).—Yao Shan, along stream in mixed woods, *C. Wang* 39215 (A), 40030 (A), May-Oct. 1936.—Tseungyuen, Yao Shan, along stream, *C. Wang* 39413 (A), June 18, 1936 (small tree with white flowers). KWANGTUNG: Hwei-yang Distr., Ling Fa Shan, Lin Fung Monastery, *W. T. Tsang* 25656 (A), Aug. 11–31, 1935 (tree 7 m. high; fruit black, edible).

Shrub or small tree up to 20 m. high; branches terete, glabrous, gray-brown, the branchlets usually purplish brown, terete, glabrous, the terminal bud obscurely appressed-pubescent near the apex, otherwise glabrous. Leaves coriaceous, ovate-oblong, 7–12 cm. long, 2.5–4 cm. wide, acuminate or obtusely acuminate at the apex, acute at the base, glabrous on both surfaces, dark glossy green above, paler beneath, the margin serrulate, varying in degree, the veins 12–16 pairs, somewhat conspicuous on both surfaces, the petiole glabrous, 1–1.5 cm. long. Flowers axillary, solitary; pedicel 1–2 cm. long, glabrous; bracteoles 2, persistent, opposite, unequal, subsepaloid, glabrous, 9–11 mm. long, 4–5 mm. wide, ovate, acute at the

apex, the smaller bracteole usually keeled along the center of the external surface; calyx-lobes 5, imbricate, glabrous, unequal, ovate, ca. 15 mm. long, 7-9.5 mm. wide, sharply acute at the apex, often subapiculate; corolla-lobes 5, connate at the base, glabrous, unequal, 17-19 mm. long, 9-12 mm. wide, obtuse to rounded at the apex; stamens ca. 25, unequal, 6-11 mm. long, the filaments joined at the base, adnate to the base of the corolla, glabrous, 2-5 mm. long (in the same flower), the anthers linear, 4-6 mm. long, hirsute on the exterior surface; ovary glabrous, ovoid, ca. 4 mm. diam., 3-celled, multi-ovulate, tapering into the glabrous style 10 mm. long, the style 3-parted at the apex for as much as 3 mm. Fruit globose, ca. 1.5 cm. in diameter.

*Adinandra nitida*, as the name signifies, is characterized by dark green leaves, extremely lustrous on the upper surface and drying to a dark brown or near black. The whole plant, except for a slight and almost unnoticeable pubescence on the terminal bud and anthers, is glabrous, an unusual feature in the genus. Large flowers and flowering parts, including the persistent almost sepaloid bracteoles, are features of distinction. The style, glabrous and three-parted up to 3 mm. is still another character of note.

Except for a single specimen, *Tsang 25656* from Kwangtung, the species seems to be confined to the province of Kwangsi. However, since several specimens were collected on or near the Kwangtung border, one may expect to find this species in future Kwangtung collections.

11. *Adinandra Howii* Merrill & Chun in *Sunyatsenia* 5: 131. 1940.

DISTRIBUTION: China (Hainan).

HAINAN: Po-ting Distr., Hing-Lung, Sheon-Kai-Na, in forest, alt. 800 m., *F. C. How 73559* (TYPE, A), Aug. 30, 1935 (tree 7 m. high with brownish red bark; leaves lustrous green above, pale green beneath; stamens pure yellow).

Small tree, 7 m. high; branches terete, glabrous, brownish red, the branchlets terete, grayish brown, glabrous except for a very fine appressed pubescence at the extreme tip of the new growth, the terminal bud densely sericeous. Leaves coriaceous, oblong-elliptic, 6-11 cm. long, 2.5-4 cm. wide, acuminate at the apex, tapering at the base, lustrous green, glabrous above, paler green, glabrous beneath, the margin serrulate, minutely glandular-apiculate, the veins 15-20 pairs, barely conspicuous on both surfaces, the petiole short, 3-5 mm. long, glabrous. Flowers not seen. Fruit axillary, solitary; pedicel glabrous, 1.5-2 cm. long; bracteoles 2, caducous, alternate; fruiting calyx-lobes 5, imbricate, glabrous, broadly ovate, ca. 8 mm. long, 5 mm. wide, the outer lobes larger with the margins entire, the inner lobes often glandular-margined. Fruit ovoid, glabrous, ca. 1 cm. diam., 3-celled, many-seeded; the placentae extending nearly completely across the cell giving the appearance of six cells; style glabrous, entire, ca. 7 mm. long.

Except for the terminal buds and the current year's growth of branchlets, this species is entirely glabrous. Its closest relative is *A. hainanensis* Hayata, and it might be considered a glabrous variety of this species were it not for the three-celled ovary. The type specimen, the only specimen examined in this study, was gathered in the immature fruiting stage, hence



a description of flowers or mature fruit must wait for further collections.

12. *Adinandra ryukyuensis* Masamune in Trans. Nat. Hist. Soc. Formosa 24: 210. 1934.

DISTRIBUTION: Liu Kiu Islands.

NO SPECIMENS EXAMINED:

Tree?; branches brown, the branchlets appressed-pilose at the ends, the buds densely ferrugineous-pubescent. Leaves coriaceous, obovate, obovate-elliptic or elliptic, 3–6 cm. long, 1–2 cm. wide, acuminate at the apex, cuneate at the base, glabrous above, ferrugineous-pubescent beneath, the margin entire, the petiole short, hirsute. Flowers axillary, solitary; pedicel ca. 2 cm. long, recurved, ferrugineous-pubescent; bracteoles 2, deltoid-lanceolate; fruiting calyx-lobes 5, imbricate, ovate, ca. 10 mm. long, 6 mm. wide, acuminate at the apex, sericeous-pubescent. Fruit glabrous.

*Adinandra ryukyuensis* and *A. Zen-Tasiroi*, the following species, must be linked together in this treatment. Both are from the Liu Kiu Island chain and may be identical. Translated descriptions are given here in an attempt to bring together as complete knowledge of the genus as possible. Although the description of the former is very incomplete, one cannot help but be impressed by the very close similarity between the two, even though varying terms have been used. Both have persistent bracteoles. In *A. ryukyuensis* the size is lacking and in *A. Zen-Tasiroi* the shape is not recorded. The calyx-lobes are almost identical in size, shape and pubescence. The fruit in both species is glabrous, a character which separates these two species from most others within their geographical range. In both species, the corolla and stamens are undescribed.

13. *Adinandra Zen-Tasiroi* Hatusima in Jour. Jap. Bot. 15: 133, 138, fig. 2. 1939.

"*Adinandra Millettii* Benth. et Hook. f. sensu Maximowicz in Mém. Biol. 12 (1886) 421, pro parte (plantas ex insl. Amami-ohsima).—Ito et Matumura, Tent. Fl. Lutch. 1 (1899) 324, pro parte.—Hayata, Icon. Pl. Formos. 2 (1911) 852.—Yamamoto et Mori in Sylvia 5 (1934) 31, pl. 1, fig. 4."

"*Adinandra Millettii* var. *Matumura* et Hayata, Enum. Pl. Formos. (1906) 45."

DISTRIBUTION: Liu Kiu Islands.

NO SPECIMENS EXAMINED:

Trees; branches brown-gray, subglabrous, the branchlets slender, densely appressed gray-hirsute. Leaves alternate, subcoriaceous, shortly petiolate, oblong-lanceolate, oblong or lanceolate, long-acuminate at the apex, cuneate at the base, 5–8 cm. long, 1.5–2 cm. wide, shining glabrous above, appressed-hirsute beneath, the margin entire or obscurely crenulate, the petiole 3–6 mm. long, densely hirsute. Flowers axillary, solitary; pedicels 1.5–2.2 cm. long, densely hirsute; bracteoles 2, opposite, immediately below the calyx-lobes, ca. 8 mm. long, 2 mm. wide, hirsute; calyx-lobes 5, imbricate, oblong-ovate or narrowly ovate-triangular, ca. 1 cm. long, 5 mm. wide, acuminate at the apex, appressed gray-villous; petals and stamens unknown; ovary glabrous, the style glabrous, ca. 6 mm. long.

A discussion of the close relationship between *A. Zen-Tasiroi* and the preceding species, *A. ryukyuensis* Masamune may be found under the latter named entity. *Adinandra Zen-Tasiroi* has the more complete description.

According to the synonymy as recorded by Hatusima, this species has

been examined by several workers (Maximowicz, Ito and Matsumura, Hayata, and Yamamoto and Mori) and erroneously placed under *A. Millettii*. This synonymy is quoted above merely for a record.

14. *Adinandra yaeyamensis* Ohwi in Act. Phytotax. Geobot. 7: 136. 1938.

DISTRIBUTION: Liu Kiu Islands.

"Riukiu Isl. Iriomote Isl. (*G. Koidzumi*—type in Herb. Imper. Univ., Kyoto).—Same island, (*G. Koidzumi*; *S. Sonohara*).—Iriomote Isl., (*G. Koidzumi*)."

Branches and branchlets terete, dark brown, the current year's branchlets terete, ascending, densely gray-brown-pilose. Leaves coriaceous, narrow oblong to narrow obovate, 5–10 cm. long, 2–3 cm. wide, glabrous, shining dark green above, paler, pilose at first beneath, later subglabrescent, obtuse at the apex, contracted or abruptly narrowed at the base, the margin lightly serrate, the veins somewhat conspicuous beneath, the midrib and petiole (4–5 mm. long) pubescent. Flowers axillary, solitary; pedicel slender, terete, 1.5–3 cm. long, recurved, pilose; bracteoles 2, at the apex of the pedicel, caducous; calyx-lobes 5, broadly elliptic or subrotund, 3–5 mm. long, finally up to 7 mm. long, very obtuse at the apex, sparsely pilose on the external surface, ciliolate along the margin; ovary globose, sparsely long-pilose, the style ca. 10 mm. long, narrowed from the base, glabrous or nearly so, the seeds shining, ca. 1.5 mm. long, dark brown, punctulate.

This species, like the others from the Liu Kiu chain of islands, is little known. No material was available for this study. The above description is merely a literal translation of Ohwi's Latin and, along with the citation of specimens, is included here in order to bring together in one place all the literature of the genus to date.

Ohwi states that the species can be separated from *A. Millettii* var. *formosana* (Hayata) Kob. by the longer pubescence, hardly appressed, the calyx-lobes obtuse at the apex, and the style, for the most part glabrous.

15. *Adinandra obtusissima* Hayata in Sasaki, Cat. Governm. Herb. 347. 1930, nom. nud.—Y. Yamamoto in Jour. Soc. Trop. Agric. 5: 347, fig. 9. 1933.—Kanehira, Formosan Trees, revised ed. 453, fig. 411. 1936.

DISTRIBUTION: Formosa.

NO SPECIMENS EXAMINED:

Branches and branchlets brown-gray, the branchlets of the current year pubescent. Leaves alternate, petiolate, obovate, 4–7 cm. long, 2–3.5 cm. wide, very obtuse, rounded or mucronate at the apex, rarely retuse, cuneate or acute at the base, the margin entire or rarely lightly serrate near the apex, in the dried state strongly revolute, shining green above, pale, minutely pubescent beneath, the midrib sulcate above, prominent, minutely pubescent beneath, the primary nerves 10–12 pairs, elevated on both surfaces, extending from the midrib at an angle of 60°–70°, the petiole 5–7 mm. long, sulcate above, pubescent beneath. Fruit axillary, solitary, the pedicel slender, 2.5 cm. long, glabrous, swollen at the apex. Sepals 5, subequal, ovate, 8 mm. long, 5 mm. wide, obtuse at the apex, pubescent on the external surface. Fruit globose, ca. 11–12 mm. diam., sericeous-pubescent, 3-celled, the style persistent, 12 mm. long.

Originally, in 1930, the name *Adinandra obtusissima* was listed as a nomen nudum by Sasaki, and attributed to Hayata. Later, in 1933,

Yamamoto gave a detailed description. He states that the leaves are very obtuse or rounded at the apex, 4–7 cm. long, 2–3.5 cm. wide, pubescent on the under surface. Both by Yamamoto and Kanehira the leaves are illustrated as nearly rotund at the apex and rather broad. The calyxlobes are subequal, ovate, 8 mm. long, 5 mm. wide, obtuse at the apex, and pubescent. The pedicel is listed as 2.5 cm. long. The fruit is described as globose, 3-celled, ca. 11–12 mm. in diameter, sericeous-pubescent with a persistent style 12 mm. long. Although not mentioned in the description, evidence of pubescence on the style is depicted in the illustrations.

Only three specimens of this species have been cited in literature, all of them collected by Matuda. The localities of collection are in southern Formosa near South Cape. They are Ariko-banti, Ako, *Matuda 25443* and Mt. Daizyurin, Takao, *Matuda 15544, 25545*.

I feel that this species is probably merely a variety of *A. Millettii* and may possibly be the same as *A. Millettii* var. *obtusissima* Kob., but since no opportunity has been available to compare the two entities, it is best to retain the specific status, even though dubious at the present time.

Material for the following three species recently published by Gagnepain has not been available for this study. Except for the added citations of literature the descriptions are quoted as originally published.

16. *Adinandra annamensis* Gagnep., n. sp. [in Not. Syst. Mus. Hist. Nat. Paris 10: 112. 1942; in Fl. Gén. Indo-Chine, Suppl. 1: 285. 1943].

Arbor  $\pm$  12–15 m. alta. Ramuli floriferi 2 mm. crassi, pilosi, pilis rufis, appressis, dein glabrescentes. Folia oblongo-lanceolata, breviter acuminate, obtusiuscula, basi cuneata, infra pilosa, pilis appressis, supra viridiora glaberrima, 5–8.5 cm. longa, 2–3.5 lata, tenuia, firma, infra punctis sparsis notata, margine tenuiter serrata; nervi secundarii 12 in utroque latere, subtus magis conspicui, cum intermedio vix prominente; venulae reticulatim dispositae, ad marginem conspicuiores; petiolus 3–5 mm. longus, rufo pilosus, pilis appressis. Inflorescentiae pedicelli axillares, solitarii, arcuato-dependentes, dense et appresso-pilosi, ante anthesin 8–10 mm. longi; alabastra globosa, 8 mm. diam.; bracteae e calyce haud remotae, caducae, 4 mm. longae. — Sepala ovato-triangula,  $\pm$  6 mm. longa lataque, dorso appresso-pilosa. Petala (haud evoluta) 5 mm. longa, dorso late sericeo. Stamina antherae connectivo acuminatae, dorso ventrequae sericeae. Ovarium dense piloso-sericeum; stylus sericeus, apice glabro, latitudine ovarii  $\frac{1}{3}$  longior. Fructus. . . .

ANNAM: Dent du Tigre, prov. Quang-tri, n° 10.382 (*Poilane*). . . TONKIN: réserve forestière de Phong-du, prov. Tien-yen (*A. Chevalier*).

Cette espèce à ovaire velu, à style 2–3 fois plus long que l'ovaire se place auprès de *A. rubropunctata* Merrill et Chun. Elle en diffère principalement: 1° par le connectif des étamines velu; 2° par le filet glabre.

17. *Adinandra caudata* Gagnep., n. sp. [in Not. Syst. Mus. Hist. Nat. Paris 10: 112. 1942; in Fl. Gén. Indo-Chine, Suppl. 1: 288. 1943].

Arbor elata, trunco 15 m. alto, cortice laevi rubescensque. Ramuli floriferi 2–3 mm. crassi, sericei mox glabri. Folia lanceolata, apice acuminato-caudata, basi cuneata, 8–17 cm. longa, 3–5 lata, supra glabra



viridiaque, infra pilosa, pilis brevibus appressis, margine tenuiter serrata; nervi secundarii 7–8 utrinque, cum intermedio subaequale; venulae retem laxum margine magis conspicuum efformantes; petiolus 7–12 mm. longus, piloso-sericeus, dein glabrescens. Inflorescentiae pedicelli axillares, 25–27 mm. post anthesin longi, ad calycem gradatim incrassati, pilosi, pilis appressis; bractee mox caducae vel nullae. — Sepala 5, appresso-pilosa, ovato-triangularia, 15 mm. longa lataque, intus glabra. Petala . . . Stamina . . . Ovarium post anthesin subglobosum, sericeo-pilosum, 15 mm. latum, 12 altum, stylo apiculatum; stylus columnaris, acuminatus, integer, 12 mm. longus, sericeus; semina immatura brunnea, nitida, tenuissime granulata, lenticulari-polyedra, 1.5–2 mm. diam.; embryo semiorbiculari.

ANNAM: Dàk-kiết, prov. Thanh-hoa, n° 1.840 (*Poilane*); Nui Bach-ma, près Hué, n° 29.828 (*Poilane*); Nhatrang, n° 4.286 (*Poilane*).

Ici les pétales, les étamines sont inconnus. Bien que les caractères importants fournis par ces organes manquent, nous croyons que cette espèce pourra assez facilement être distinguée de tout autre.

18. *Adinandra donnaiensis* Gagnep., n. sp. [in Not. Syst. Mus. Hist. Nat. Paris 10: 113. 1942; in Fl. Gén. Indo-Chine, Suppl. 1: 283. 1943].

Arbor 8–15 m. alta, trunco 15–25 cm. crasso. Ramuli floriferi 1–1.5 mm. diam., glaberrimi, grisei. Folia lanceolata, basi cuneata, apice acuminato-obtusiuscula, 6–10 cm. longa, 2.5–3 lata, utrinque glabra, margine leviter serrata; nervi secundarii 8–10 utroque latere, ad marginem arcuati, confluentesque; venulae tenues, reticulatum dispositae; petiolus gracilis, 7 mm. longus, glaber, supra canaliculatus. Inflorescentia ad ramulos 1–2-ennos inserta; pedicelli axillares, solitarii vel geminati vel terni, graciles, 15 mm. longi, ad apicem gradatim incrassati; alabastra conica, 9–10 mm. longa; bractee oppositae, e calyce vix remotae, ovato-obtusae, 2–5 mm. longae, ciliolatae. — Sepala 5, reniformia,  $\pm$  2 mm. longa, 3–4 mm. lata, margine ciliolata, supra sericea. Petala 5, triangularia, 8 mm. longa, supra basin 5 mm. lata, glaberrima. Stamina numerosa; filamentum plano, brevi (1.5 mm.), breviter piloso; anthera triangulo-mucronata, 3 mm. longa, mucrone 1 mm. longo incluso; loculi praesertim ad marginem sericei. Ovarium globoso-depressum, 3–5 mm. latum, glaberrimum; stylus longe conicus, 4–5 mm. longus, glaberrimus; loculi 3, pluriovulati, placentariis ad parietes radiantibus. Fructus immaturus globosus, glaber, 7–8 mm. diam., maturus niger (*Poilane*).

ANNAM: massif du Bi-doup, prov. Haut-Donnai, n° 30.724 et 30.848 (*Poilane*). CAMBODGE: Pu-chom, prov. Kompongchnang, n° 28.793 (*Poilane*).

Diffère de *A. laotica* Gagnep.: 1° ramules plus grêles; 2° feuilles 2 fois plus courtes et étroites; 3° marge du limbe denticulée et veinules visibles; 4° pédicelles un tiers plus courts; 5° bractées opposées; 6° sépales réniformes; 7° connectif des anthères égalant la moitié des loges, glabre.

#### DOUBTFUL SPECIES

19. *Adinandra kweichowensis* Hu in Bull. Fan. Mem. Inst. Biol. 8: 145. 1938.

Although no material of the species has been available for this study, I feel very dubious of its placement in the genus *Adinandra*. The description of the species leads one to believe that it belongs to the genus *Cleyera*.

Hu states in his description, "arbor ad 4 m. alta, omnino glabra; folia . . . margine integra leviter revolutaque . . . petioli robusti . . . 1.5 cm. longi; . . . fructi 1-3, . . . sepala 5 ovata 5 mm. longa, marginibus ciliata; stylus tenuis 5 mm. longus; bacca globosa 8 mm. diametro; semina pauca, magna compressa . . . 3 mm. longa, 2.5 mm. lata."

The completely glabrous plant, the entire margin of the leaves, the petiole, robust and 1.5 cm. long, the margin of the sepals ciliate, the globose fruit 8 mm. in diameter and finally the few seeds are all features of *Cleyera japonica* Thunb. The only variations, in my opinion, are the sepals (5 mm. long) and the style (5 mm. long). In *Cleyera* the sepals are seldom longer than 3 mm. and rounded and the style is usually, not always, two- or three-parted.

#### EXCLUDED SPECIES

*Adinandra bracteata* Li in Jour. Arnold Arb. 26: 65. 1945 = *Ternstroemia* ? *insignis* Wu in Bot. Jahrb. 71: 195. 1940.

Although no flowers or fruit remain on the specimen, Wang 39626, designated by Li as the type of *A. bracteata*, from the fragments of his dissection showing the many glabrous stamens arranged in series, the leaf-buds, and the sub- or pseudo-verticillate arrangement of leaves and branchlets, there seems little doubt that the species does not belong to the genus *Adinandra*, but probably to *Ternstroemia*.

There is a close relationship between Li's species and *Ternstroemia insignis* Wu, collected at the same locality Lao Shan in Kwangsi. However, from the descriptions there can be no certainty that they are identical. There is variation in leaf-size and stamen measurements. Li stated that the stamens of *A. bracteata* were "1.1-1.3 cm." long. The fragments of his dissections show stamens measuring 5-6 mm. in length, which compare favorably with those (5 mm. long) found in *T. insignis*. However, these stamens may have been taken from an unopened flower-bud, since the filaments appear very short and undeveloped.

*Adinandra Chingii* Metcalf in Lingnan Sci. Jour. 11: 19. 1932 = *Cleyera japonica* Thunberg emend. Sieb. & Zucc. Fl. Jap. 153. 1941.

*Adinandra obscurinervia* Merrill & Chun in Sunyatsenia 2: 283, fig. 35. 1935 = *Cleyera japonica* Thunberg emend. Sieb. & Zucc. var. *lipingensis* (Handel-Mazzetti) Kobuski in Jour. Arnold Arb. 18: 127. 1937.

*Adinandra stenosepala* Hu in Bull. Fan. Mem. Inst. Bot. Ser. 8: 146. 1938 = *Sideroxylon* (Planchonella) *stenosepala* Hu in Bull. Fan. Mem. Inst. Biol. Ser. 10: 129. 1940.

#### PHILIPPINE SPECIES

Fifteen species have been described from the Philippine Islands under the genus *Adinandra*. The present study recognizes eight. Of these eight species six have been described by Merrill and one each by A. D. E. Elmer and C. B. Robinson. Three of the earlier described species have been transferred to other genera: *A. coriacea* Elmer to *Ternstroemia gymnanthera*

(W. & A.) Sprague, *A. urdanetensis* Elmer to *T. urdanetensis* (Elmer) Kobuski, and *A. montana* Merrill to *Cleyera japonica* Thunb. var. *montana* (Merrill) Kobuski. This last-named variety is the first representative of the genus *Cleyera* in the Philippine Islands.

The Philippine species of *Adinandra* form a distinct group among themselves. Their relationships are more clearly with the Eastern Asiatic species than with the Indo-Malaysian group.

Below are listed the characters helpful in specific identification. Under these characters are recorded the species as far as present-day knowledge permits.

#### CHART FOR PHILIPPINE SPECIES OF ADINANDRA

Bracteoles		Calyx-lobes	
PERSISTENT	CADUCOUS	PUBESCENT	GLABROUS
<i>apoensis</i>	<i>elliptica</i>	<i>elliptica</i>	<i>apoensis</i>
<i>leytensis</i>	<i>luzonica</i>	<i>leytensis</i>	<i>Loheri</i>
<i>Loheri</i>	<i>Macgregorii</i>	<i>luzonica</i>	<i>Macgregorii</i>
<i>nigro-punctata</i>	<i>maquilingensis</i>	<i>maquilingensis</i>	<i>nigro-punctata</i>
Corolla-lobes		Filaments	
PUBESCENT	GLABROUS	PUBESCENT	GLABROUS
<i>apoensis</i>	None	<i>apoensis</i>	<i>elliptica</i>
<i>elliptica</i>		<i>leytensis</i>	<i>Loheri</i>
<i>leytensis</i>		<i>luzonica</i>	<i>Macgregorii</i>
<i>Loheri</i>		<i>nigro-punctata</i>	<i>maquilingensis</i>
<i>luzonica</i>			
<i>Macgregorii</i>			
<i>maquilingensis</i>			
<i>nigro-punctata</i>			
Ovary		Style	
PUBESCENT	GLABROUS	PUBESCENT	GLABROUS
<i>elliptica</i>	<i>apoensis</i>	<i>maquilingensis</i>	<i>apoensis</i>
<i>luzonica</i>	<i>leytensis</i>		<i>elliptica</i>
<i>Macgregorii</i>	<i>Loheri</i>		<i>leytensis</i>
<i>maquilingensis</i>	<i>nigro-punctata</i>		<i>Loheri</i>
			<i>luzonica</i>
			<i>Macgregorii</i>
			<i>nigro-punctata</i>
Ovary			
THREE-CELLED		FIVE-CELLED	
<i>elliptica</i>		<i>apoensis</i>	
<i>leytensis</i>		<i>luzonica</i>	
<i>Loheri</i>		<i>nigro-punctata</i>	
<i>Macgregorii</i>			
<i>maquilingensis</i>			



## KEY TO THE PHILIPPINE SPECIES

- A. Ovary and fruit pubescent; bracteoles caducous.
- B. Ovary and fruit 5-celled; calyx-lobes, ovary and fruit covered with a dense canescent pubescence; filaments pubescent; leaves conspicuously reticulate-veined on the under surface.....20. *A. luzonica*.
- BB. Ovary and fruit usually 3-celled (rarely 4-celled); pubescence when present straggling or appressed, not canescent; filaments glabrous; leaves not conspicuously reticulate-veined on the under surface.
- C. Leaves membranaceous or submembranaceous, narrowly elliptic, the apex long, tapering; pedicels distinctly slender, up to 3.5 cm. long; style always entire, glabrous.....21. *A. elliptica*.
- CC. Leaves coriaceous; pedicels robust, seldom over 2-2.5 cm. long; style entire with a tendency to separate at the apex, or divided.
- D. Style straggling-pubescent, at least the lower half; bracteoles caducous (when present broadly ovate, ca.  $2 \times 2$  mm.); calyx-lobes broadly ovate ca.  $10 \times 7$  mm.....22. *A. Macgregorii*.
- DD. Style glabrous; bracteoles caducous (when present oblong-obovate ca.  $6 \times 3$  mm.); calyx-lobes narrow-ovate ca.  $8 \times 4.5$  mm.....23. *A. maquilingsensis*.
- AA. Ovary and fruit glabrous; bracteoles persistent.
- B. Ovary and fruit 3-celled.
- C. Ovules and seeds few; seeds up to 5 mm. long, flat, seldom more than 20 maturing.....24. *A. Loheri*.
- CC. Ovules and seeds many; seeds seldom over 2 mm. long, flat, many maturing (often more than 100).....25. *A. leytenensis*.
- BB. Ovary and fruit 5-celled.
- C. Bracteoles rounded, ca.  $3 \times 3-4$  mm.; ovary ovoid or conical, tapering into the style; stamens ca. 50.....26. *A. nigro-punctata*.
- CC. Bracteoles smaller, broader than long,  $1.5-2 \times 2.5-3$  mm.; ovary distinctly globose, quite flattened at the apex with the style rising abruptly; stamens ca. 35.....27. *A. apoensis*.

20. *Adinandra luzonica* Merrill in Philipp. Govt. Lab. Bur. Bull. 29: 29. 1905; in Philipp. Jour. Sci. 1 (Suppl.): 95. 1906; Enum. Philipp. Fl. Plts. 3: 73. 1923. — Melchior in Nat. Pflanzenfam. ed. 2, 21: 144. 1925.

DISTRIBUTION: Luzon (Bataan, Bontoc, Tayabas, Zambales), Negros (Negros Oriental).

LUZON: Bataan: Lamao River, Mt. Mariveles, *T. E. Borden* [P.B.F.] 1360 (NY, US), July 1904. — Lamao River, Mt. Mariveles, on exposed windswept ridges, alt. 1200 m., *H. N. Whitford* 446 (ISOTYPES C, NY, US), July 21, 1904. — Lamao River, Mt. Mariveles, *H. N. Whitford* 1184 (ISO-PARATYPES, NY, US), March 1905. — Mt. Mariveles, *A. D. E. Elmer* 6906 (NY), Nov. 1904. Bontoc: Mt. Pukis, *M. Ramos & G. Edaña* [P.B.S.] 37819 (A), March 1920. Tayabas: Mt. Dingalan, *M. Ramos & G. Edaña* [P.B.S.] 26630 (A, NY, US), Aug.-Sept. 1916. Zambales: *H. M. Curran & M. L. Merritt* [P.B.S.] 8255 (NY, US). NEGROS: Prov. Negros Oriental, Dumaguete, Mt. Cuernos, *A. D. E. Elmer* 9812 (A, C, M, NY, US), April 1908.

Tree up to 15 m. high, branching near the top; branches numerous, suberect, giving bushy appearance, the branchlets grayish brown, glabrous, striate, the very young branchlets, terminal bud, and very young leaves densely canescent. Leaves coriaceous, oblong-elliptic, 7-12 cm. long, 2.5-5 cm. wide, acute, occasionally somewhat acuminate at the apex, cuneate at the base, usually glabrous on both surfaces, occasionally slightly pubescent with few scattered hairs along the midrib on the under surface, the margin subrevolute, lightly and obscurely denticulate, the veins (ca. 15 pairs)

conspicuous beneath but not more prominent than the outstanding network of secondary and lesser veins, the petiole ca. 5 mm. long, usually glabrous or becoming so. Flowers solitary, axillary; pedicel appressed-pubescent at first, later becoming glabrous, 10–15 cm. long; bracteoles 2, opposite or slightly alternate, quickly caducous, when present unequal, triangular, 3–3.5 mm. long, ca. 2.5 mm. wide at the base, pubescent; calyx-lobes 5, imbricate, unequal, broadly ovate, obtuse or subrotund at the apex, ca. 8 mm. long, 8–9 mm. wide, densely appressed-hoary-pubescent on the external surface, glabrous within, the outer lobes thicker with over-all pubescence, the inner lobes pubescent only at the center with the margins scarious and less pubescent; corolla-lobes 5, connate at the base, 10–12 mm. long, ca. 9 mm. wide, appressed-hoary-pubescent on the median portion of the external surface; stamens 40–45, seriate, 6–8 mm. long, the filaments unequal, 3–4.5 mm. long, joined at the base and adnate to the base of the corolla, villous, the anthers nearly equal, ca. 3 mm. long, villous, tapering into a short apicule; ovary ovoid-conical, densely canescent, 5-celled, multi-ovulate, tapering at the apex into the style, the style glabrous except at the very base, 5-parted or tending to split into 5 parts. Fruit subconical-globose, ca. 1 cm. diam., hoary-pubescent, 5-celled, many-seeded; seeds brown, shining, ca. 1.5 mm. long.

This species was the first of the genus described from the Philippines. One of the most outstanding characters is the reticulate appearance of the veins, especially on the lower surface. All veins, from the primary to the finer reticulations are of almost uniform prominence. The canescent pubescence of the calyx, corolla, ovary and that persisting through the fruiting stage on the calyx and fruit present another character excellent for distinguishing the species.

Two specimens cited present considerable variation in leaf-size. *Ramos & Edaño 28736* collected in Tayabas Prov. of Luzon has leaves over 15 cm. long and, in some instances more than 8 cm. wide. The flowers are immature and appear smaller than those of the typical specimen. However, the distinct veining and pubescence are the same. On the other hand, *Ramos & Edaño 26630*, from the same province, has leaves 8–15 cm. long and only 2–3 cm. wide. The calyx-lobes are smaller also, ca. 6 mm. long. However, like the specimen mentioned immediately above, in other respects, it agrees with the typical specimen.

VERNACULAR NAME: *Kamiin* (Sambáli).

21. *Adinandra elliptica* C. B. Robinson in Philipp. Jour. Sci. Bot. 3: 206. 1908.—Merrill, Enum. Philipp. Fl. Plts. 3: 72. 1923.—Melchior in Nat. Pflanzenfam. ed. 2, 21: 144. 1925.

*Adinandra integerrima* Vidal, Rev. Pl. Vasc. Filip. 56. 1886. Non T. Anderson.

*Adinandra dumosa* Vidal, Sinopsis Fam. Gen. Pl. Filip., Atlas 14, t. 13, f. A. 1883. Non Jack.

*Adinandra Robinsonii* Elmer, Leaf. Philipp. Bot. 8: 2836. 1915.—Merrill, Enum. Philipp. Fl. Plts. 3: 73. 1923.—Melchior in Nat. Pflanzenfam. ed. 2, 21: 144. 1925.

DISTRIBUTION: Luzon (Benguet, Nueva Ecija, Nueva Viscaya, Sorsogon), Mindanao (Bukidnon, Davao, Misamis), Mindoro, Negros (Negros Oriental), Panay.

LUZON: Benguet Prov.: Sablan, *R. S. Williams 1369* (ISOTYPES NY, US),

Nov. 18, 1904 (flowers whitish).—Baguio, *R. S. Williams 1115* (NY, US), June 29, 1904.—*M. S. Clemens 17196* (NY), Dec. 1920.—*E. D. Merrill 1766* (G, M), May 1914. Nueva Ecija Prov.: Mt. Umingan, *M. Ramos & G. Edaño* [P.B.S.] 26470 (A, US). Nueva Viscaya Prov.: *M. Ramos & G. Edaño* [P.B.S.] 45597 (A, NY), May-June 1925. Prov. Sorsogon: *M. Ramos* [P.B.S.] 23359 (A, NY, US), July-Aug. 1915. MINDANAO: Davao Distr.: Mt. Apo, Todaya, *A. D. E. Elmer 11461* (ISOTYPES of *A. Robinsonii*, A, C, G, M, NY, US), Aug. 1909. Bukidnon Subprov.: Mt. Lipa, *M. Ramos & G. Edaño* [P.B.S.] 38496 (A, US), [P.B.S.] 38981 (A), June-July 1920.—*A. L. Cénabre* [P.B.F.] 29624 (A, NY), June 1924. MINDORO: *M. L. Merritt* [P.B.F.] 8720 (NY, US), Jan. 1928.—Mt. Calavite, *M. Ramos* [P.B.S.] 39415 (A), [P.B.S.] 39487 (A), April 1921. NEGROS: Prov. Negros Oriental, Dumaguete, Cuernos Mts., *A. D. E. Elmer 10185A* (M, NY, US), May 1908. PANAY: Prov. Antique, *R. C. MacGregor* [P.B.S.] 32537 (A), May-Aug. 1918.

Small tree; branchlets terete, brownish, glabrescent, the very young branchlets and terminal buds ferrugineous-tomentose. Leaves submembranaceous, oblong-elliptic, (3.5–) 6–10.5 cm. long, (1.5–) 2.5–3.5 cm. wide, acuminate at the apex, narrowed at the base, usually glabrous above, straggling to densely pubescent beneath, glabrescent at maturity except along the midrib and margin, the margin glandular-serrate, sometimes ciliate, the veins ca. 15 pairs, somewhat prominent beneath with all the orders of veins equally conspicuous, the petiole 2.5–6 mm. long, usually pubescent. Flowers axillary, solitary; pedicels up to 3.5 cm. long, slender, usually somewhat recurved, thinly pubescent; bracteoles 2, caducous, opposite and immediately below calyx; calyx-lobes 5, imbricate, broadly ovate, unequal, 6–7 mm. long, ca. 5 mm. wide; not as thick as in most species with less conspicuous variation at the margin, glandular-denticulate, the two outer lobes straggling-pubescent, the inner lobes quite glabrous; corolla-lobes 5, connate at the base, ovate, quite acute at the apex, densely pubescent in the middle of the exterior surface, ca. 10 mm. long, 4–5 mm. wide; stamens ca. 30, appearing as a single series, the filaments glabrous, 2–3 mm. long, adnate to the base of the corolla, joined inconspicuously, appearing almost free, the anthers 2–4 mm. long, densely pubescent, with an apicule ca. 1 mm. long; ovary subconical, 3-celled, densely pubescent, tapering at the apex into a glabrous style ca. 1 cm. long, the ovules many. Fruit ca. 1 cm. diam., 3-celled, straggling-pubescent, multi-ovulate, the seeds minute, dark brown-black.

The outstanding characters of this species are: (1) the submembranaceous elliptic leaves; (2) the generally long slender pedicels; (3) the 3-celled ovary and fruit; (4) the 1 cm. long entire glabrous style; (5) the thin calyx-lobes; (6) the glabrous, nearly free filaments and pubescent anthers; (7) the seemingly always caducous bracteoles; and (8) the rather straggling pubescence.

*Adinandra Robinsonii* Elmer is included here as a synonym. After studying the species, I can find no characters suitable for separating them. Elmer, in introducing *A. Robinsonii*, remarked that it was very close to *A. elliptica* and offered no basis for separation. Later, Merrill suggested that the relationship seemed too close for separation, although he continued to list them as distinct entities.

Questionably cited here is *Ramos & Edaño 45597*. The style is glabrous and entire, but the leaves are thicker, more coriaceous than most specimens of *A. elliptica* and the base is less acute. *Williams 2533* from Mindanao



and *Merritt 8834* from Mindoro have leaves large for the species. However, in *Williams 2533*, the dissections of the flowers showed no differences from typical *A. elliptica*. My dissections of the ovary of the *Williams* number were unsatisfactory. *Merritt 8834* is a fruiting specimen. Several dissections showed the fruit to be typically 3-celled. However, on the same specimen were fruits incompletely 3-celled appearing 5- or 6-celled.

The leaves of *Elmer 10185*, *10185A* from the island of Negros are smaller and the pubescence generally more dense, but typical of the species. This latter character is true especially of the pedicel and calyx-lobes.

VERNACULAR NAME: *Puyaka* (Mangyan).

22. *Adinandra Macgregorii* Merrill in Philipp. Jour. Sci. Bot. 9: 319. 1914; Enum. Philipp. Fl. Plts. 3: 73. 1923. — Melchior in Nat. Pflanzenfam. ed. 2, 21: 144. 1925.

DISTRIBUTION: Luzon (Benguet, Lepanto).

LUZON: Benguet Subprov.: Pauai, *J. K. Santos* [P.B.S.] 31924 (US), April-June 1918. — Mt. Pulog, *M. Ramos & G. Edaño* [P.B.S.] 40398 (A), Sept. 1921. — Mt. Pauai, *E. Quisumbing & M. Sulit* [P.B.S.] 82356 (A, NY), March 1931. — Pauai, in forest, alt. 2100 m., *R. C. MacGregor* [P.B.S.] 8425 (ISOTYPES, NY, US), June 1909. — Pauai, *M. S. Clemens* 9234 (A, G, US), Jan. 1915. — *R. J. Alvarez* [P.B.S.] 18372 (US), Jan. 1909. Lepanto Subprov.: Mt. Data, *M. Ramos & G. Edaño* [P.B.S.] 40276 (A, US), Sept. 1921. — Balili (Mt. Data), *E. D. Merrill* 4650 (NY, US), Nov. 1905.

Tree 15 m.; branchlets terete, grayish, glabrous, the very young branchlets invested with a dense, tawny, appressed-villous pubescence. Leaves coriaceous, elliptic to oblong-elliptic, 5–10 cm. long, 2–4 cm. wide, apex usually acuminate, acute to somewhat rounded at the base, the margins minutely but distinctly glandular-denticulate, the upper surface glabrous except occasionally near the very base, the lower surface with scattered, appressed tawny pubescence becoming glabrescent, the veins ca. 15 pairs, anastomosing, about equally conspicuous on both surfaces, the petiole 3–5 mm. long, densely pubescent beneath, less so above. Flowers axillary, solitary; pedicels stout, recurved, up to 2.5 cm. long, measuring as much as 3 mm. diam. near the calyx, pubescent; bracteoles 2, caducous; calyx-lobes 5, imbricate, unequal, up to 10 mm. long, ca. 7 mm. wide, ovate, acute at the apex, the outer lobes straggling-pubescent over the entire external surface, the inner lobes pubescent except along the margin, glandular-denticulate; corolla-lobes 5, unequal, connate at the base, obovate, up to 14 mm. long, 7–10 mm. wide, tawny-pubescent on the median portion of the external surface; stamens ca. 30, unequal in length, 8–10 mm. long, probably seriate, the filaments firmly adnate to the base of the corolla, glabrous, 3–5 mm. long, the anthers noticeably large, ca. 5 mm. long, usually equal or subequal, hirsute, prolonged at the apex into an apicule; ovary pubescent, 3- or 4-celled, tapering gradually at the apex into a broad gradually narrowed style (in type especially) which is split into 3 or 4 parts at the apex, pubescent except near the tip, the 3 or 4 stigmas appearing oblique. Fruit not seen.

From the material examined, this species seems to be localized in the Pauai area of Benguet Subprovince. All the material cited above, save two sheets from the adjoining Subprovince of Lepanto, are from Benguet. These Lepanto sheets are *Merrill 4650* and *Ramos & Edaño 40276*, collected at Mt. Data.

The ovary is generally three-celled and the style three-parted, three-ridged or entire. The type specimen seems to be the exception. Only two dissections were possible from the type and both showed a four-celled ovary. This was to be expected as the style, in both cases, was four-parted. On the same specimen were styles that were three-parted. In the type, the style is very thick at the base, and although tapering somewhat towards the apex remains quite bulky. In other cases, where the style is three-parted, the tapering is more finely drawn out. There is variation in the extent of pubescence of the style. It may be present on the lower half only or may extend up to the divided portion. Never is the style completely pubescent.

The leaves are coriaceous, resembling in shape those of *A. elliptica* C. B. Robinson, the closest relative, the base, however, usually being more rounded.

In *A. elliptica*, the floral parts are generally smaller. The calyx-lobes measure 6–7 mm. and the corolla-lobes 10 mm. in length. The style is glabrous and always entire. The leaves are membranaceous or submembranaceous and taper at both ends.

These two species are very difficult to separate, especially in the early stages of leaves and flower.

VERNACULAR NAME: *Batinai* (Igorot).

23. *Adinandra maquilingensis* Merrill in Philipp. Jour. Sci. Bot. 9: 317. 1915; Enum. Philipp. Fl. Plts. 3: 73. 1923. — Melchior in Nat. Pflanzenfam. ed. 2, 21: 144. 1925. — Sasaki, Cat. Governm. Herb. 347. 1930.

DISTRIBUTION: Luzon (Laguna, Tayabas).

LUZON: Laguna: Mt. Maquiling, *M. Ramos* [P.B.S.] 13650 (ISOTYPES, C, US), Sept. 1911. — Los Baños, Mt. Maquiling, *A. D. E. Elmer* 17687 (A, C, G, M, NY, US), 18200 (A, C, G, M, NY, US), June-July 1917. Tayabas: Umiray, *A. Loher* 13999 (A).

Small tree ca. 12 m. high; branchlets terete, brownish, generally glabrous, except at the very tips where finely appressed-pubescent. Leaves coriaceous, oblong-elliptic to oblong-obovate, 3.5–6 cm. long, 1.5–2.5 cm. wide, acuminate at the apex, acute at the base, glabrous above, sparsely straggling-pubescent or glabrous beneath (pubescent when very young), the margins crenulate-denticulate along the upper half, the lower half quite entire, the veins ca. 12 pairs, distinct but not prominent, the petioles 3–5 mm. long, occasionally pubescent on the lower surface. Flowers axillary, solitary; pedicels stout, recurved, straggling-pubescent at first, later glabrous, 1.5–2 cm. long; bracteoles 2, caducous, elongate-obovate when present, ca. 6 mm. long, 3 mm. wide, straggling-pubescent; calyx-lobes 5, imbricate, narrow-ovate, apiculate, unequal, the outer lobes ca. 8 mm. long, 4.5–5 mm. wide, pubescent over all, the inner 3 lobes somewhat broader, ca. 8 mm. long, 6–6.5 mm. wide, pubescent in the center, glabrous at the membranous margin; corolla-lobes 5, connate at the base, unequal, obovate, tapering quickly and abruptly at the base, obtuse at the apex, 11.5–12 mm. long, 5–7 mm. wide, pubescent on the median portion of the exterior surface; stamens ca. 35, 7–9 mm. long, unequal, the filaments 4–6 mm. long, generally glabrous, pubescent only where joined to the anthers, the anthers

ca. 3 mm. long, densely hirsute; ovary pilose, 3-celled, multi-ovulate, the style hirsute, 7 mm. long, 3-parted, the apices glabrous. Mature fruit not seen.

From the material examined, it appears that this species is localized in the Mount Maquiling area in the Province of Laguna on the Island of Luzon.

The bracteoles although caducous do not fall as quickly as those in the majority of species. When present, they are unusual in character, being long-obovate ( $6 \times 3$  mm.) and nearly equalling the calyx in length. The calyx-lobes themselves are characteristic, long and quite narrowly ovate, tapering to a distinct apicule, and covered with a straggling pubescence. The anthers are, as usual, hirsute with the pubescence extending down the filaments for a short distance which are glabrous for most of their length. The ovary is pilose, 3-celled and multi-ovulate, tapering into a style hirsute for almost its entire length, glabrous only at the very apex which is 3-parted.

24. *Adinandra Loheri* Merrill in Philipp. Jour. Sci. Bot. 9: 318. 1914; Enum. Philipp.

Fl. Plts. 3: 72. 1923. — Melchior in Nat. Pflanzenfam. ed. 2, 21: 144. 1925.

*Adinandra rostrata* Merrill, in op. cit. 316. — Melchior, loc. cit.

*Adinandra coriacea* Merrill, in op. cit. 317. — Melchior, loc. cit.

DISTRIBUTION: Luzon (Rizal, Laguna).

LUZON: Rizal: Oriud, in primary forests at medium altitudes, *A. Loher* 5604 (ISOTYPE, K), Dec. 1905. — Montalban, *A. Loher* 12642 (A), Oct. 1912. — *A. Loher* 14486 (A), Oct. 1913. Laguna: Dahican River, *M. Ramos* [P.B.S.] 1567 (ISOTYPES of *A. rostrata*, M, NY), Sept. 13, 1912. — *F. L. Amarillas* [P.B.F.] 24663 (NY, US), Nov. 1915.

Tree, generally glabrous except the terminal vegetative buds and very young branchlets; branchlets terete, grayish, the terminal buds tawny-villous. Leaves coriaceous, oblong-elliptic, glabrous or glabrescent, 8–14 cm. long, 3.5–6.5 cm. wide, broadly rounded to broadly or shortly acuminate at the apex, acute at the base tapering into the petiole, the margin crenulate to crenulate-denticulate, the veins 11–15 pairs, anastomosing near the margin, the petiole 5–7 mm. long. Flowers axillary, solitary; pedicels glabrous, curved, 2–4 cm. long; bracteoles 2, opposite, immediately below the calyx, persistent, unequal, broadly triangular to suborbicular,  $2.5 \times 3$  mm. and  $2.5 \times 2.5$  mm., scattered appressed-pubescent, the margins ciliolate; calyx-lobes 5, imbricate, thickened, glabrous, decidedly rounded (often splitting) at the apex, unequal, wider than long, ca. 5.5–6 mm. long, 6–7 mm. wide; corolla-lobes 5, connate at the base, obovate to broadly obovate, ca. 1.5 cm. long, 1.2 cm. wide, pubescent on the median portion of the dorsal surface; stamens 40–50, adnate to the base of the corolla, unequal, 7–11 mm. long, the filaments 4–8 mm. long, joined nearly their entire length, hirsute on the external surface, the anthers ca. 3 mm. long, oblong, acute, hirsute; ovary glabrous, conical-ovoid, 3-celled, multi-ovulate, tapering at the apex into a glabrous, entire style ca. 6 mm. long. Fruit glabrous, globose, ca. 1.5 mm. diam., 3-celled; seeds ca. 25, dark, shining, scrobiculate, 5–6 mm. long.

The nearly glabrous character of this species is one of its unusual features. The terminal buds and very young branchlets, the dorsal surface



of the corolla-lobes and the stamens appear to be the only exceptions. The anthers are always hirsute, even in the most glabrous species. Another feature of note is the persistent, opposite bracteoles.

Merrill, in his original description of this species, records the ovary as 5-celled. In all the material examined the ovary and fruit are consistently 3-celled. Undoubtedly Merrill had poor material at his disposal when he devised this species, since the fruit is not described and the ovary is recorded as 5-celled. An isotype in the Kew herbarium which has been available for this study possesses both fruit and flowers. Had Merrill had such a specimen he would have seen the relationship between *A. rostrata* and *A. Loheri* at the time of publication, since they were published simultaneously. *Adinandra rostrata* was published from the fruit alone. The type material of this latter entity shows the very large 3-celled fruit with large (5–6 mm. long) seeds which are few (10–20) in number. The pedicel is unusually long, measuring up to 4 cm. *Adinandra Loheri* was described from flowering material in which the pedicels measured 2 cm. in length. Unfortunately the two specimens used as types of these two species represented the extremes in pedicel length, and since one was described from flowers and the other from the fruit they appeared to be different. Since then material has been collected which includes this variation in pedicel-length. In *Loher* 12642, a flowering specimen, the pedicels vary from 2–3.5 cm. in length on the same specimen.

Although several Philippine species are known to have 3-celled fruit, this is the only species in which the fruit has been described. It agrees with those Indo-Malayan species with 3-celled fruit in having fewer but larger seeds than the species in which the fruit is 5-celled.

VERNACULAR NAME: *Malambot* (Tagalog).

25. *Adinandra leytenensis* Merrill in Philipp. Jour. Sci. Bot. 9:377. 1914; Enum. Philipp. Fl. Plts. 3:72. 1923. — Melchior in Nat. Pflanzenfam. ed. 2, 21:144. 1925.

DISTRIBUTION: Leyte.

LEYTE: Masaganap, near Jaro, in forests, alt. 600 m., C. A. Wenzel 760 (ISOTYPES, A, C, M, US), May 27, 1914.

Tree 17 m. high; branchlets terete, glabrous, brown, the terminal buds appressed-tawny-pubescent. Leaves coriaceous, subelliptic, 5–8 cm. long, 2.5–4 cm. wide, obtuse to rounded at the apex, narrowly acute at the base, glabrous, somewhat shining, greenish above, roughened, darker, appressed-pubescent beneath, the margin obscurely denticulate, the veins ca. 12 pairs, prominent on both surfaces, anastomosing near the margin, the reticulations very distinct on both surfaces, the petioles ca. 5 mm. long. Flowers axillary, solitary; pedicels recurved, stout, ca. 1.3 cm. long, scattered-pubescent; bracteoles 2, opposite, immediately below the calyx, persistent, unequal, ca.  $2 \times 3$  and  $3 \times 4$  mm., broadly rounded, closely appressed-pubescent, the surface rough, thick, the margins ciliate; calyx-lobes 5, imbricate, rounded, finely appressed-pubescent, unequal, the outer two ca. 5 mm. long, 6–6.5 mm. wide, thick with little or no scarious margin, eciliate, the inner three gradually thinner toward the margin becoming scarious, somewhat ciliate; corolla-lobes 5, connate at the base, obovate,

ca. 13 mm. long, 8.5–10 mm. wide, rounded at the apex, tapering rapidly and thickened at the base, finely appressed-pubescent on the external surface except along the scarious margin; stamens ca. 40, unequal, 6–10 mm. long; filaments extremely variable in length, 2–6 mm. long, joined the entire length of the shortest filaments, densely hirsute except for ca. 1 mm. at the base of the external surface where they are adnate to corolla, the anthers ca. 4 mm. long, approximately equal in length, hirsute, lanceolate; ovary glabrous, conical-ovoid, 3-celled, multi-ovulate, tapering at the apex into an entire glabrous style ca. 7 mm. long. Fruit not seen.

The characters helpful in distinguishing this species are: (1) the unequal persistent bracteoles; (2) the roughened, thick, pubescent calyx-lobes; (3) the long stamens with the filaments joined their entire length forming a tube and sufficiently adnate to the base of the corolla (1 mm.) to fall off intact with the corolla; (4) the glabrous 3-celled ovary; and (5) the glabrous entire style.

The veining of the leaves of the species resembles very much that found in those of *A. luzonica* Merrill. However, the apex of the leaf of the present species is rounded and the pubescence of the under surface less distinct. The midrib also is more roughened.

26. *Adinandra nigro-punctata* Merrill in Philipp. Jour. Sci. Bot. 9: 320. 1914; Enum. Philipp. Fl. Plts. 3: 73. 1923. — Melchior in Nat. Pflanzenfam. ed. 2, 21: 144. 1925.

DISTRIBUTION: Leyte.

LEYTE: Dagami, in forests, *M. Ramos* [P.B.S.] 15355 (ISOTYPE, US), Aug. 13, 1912.

Tree ca. 10 m. high; branchlets numerous, terete, glabrous, grayish brown, pubescent at very tip only and reddish brown when very young, the terminal buds pubescent. Leaves coriaceous, glabrous except when unfolding, elliptic-oblong, 4–7 cm. long, 1.5–3 cm. wide, the apex broadly blunt-acuminate, minutely retuse, the base acute, the margin obscurely glandular-denticulate, the veins 7–8 pairs, equally evident on both surfaces, the petiole ca. 5 mm. long. Flowers axillary, solitary; pedicels glabrous, stout, ca. 2 cm. long; bracteoles 2, persistent, opposite, immediately below the calyx, glabrous, unequal, suborbicular to obovate, ca. 3 mm. long, 3–4 mm. wide; calyx-lobes 5, imbricate, glabrous, subequal, rounded at the apex, the 2 outer lobes smaller, ca. 7–8 mm. long and broad, the margin lightly ciliolate, the inner 3 lobes longer, ca. 10 mm. long, 7–8 mm. wide, the margin more noticeably ciliolate; corolla-lobes [descrip. fide Merrill] 5, broadly rounded, slightly retuse, the median exposed parts (dorsal surface) very densely hirsute, otherwise glabrous; stamens (fide Merrill) about 50, the filaments 5 mm. long, densely hirsute, the anthers ovate-lanceolate, somewhat acuminate, 4 mm. long, densely hirsute; ovary glabrous, ovoid, 5-celled, the ovules very numerous in each cell; style glabrous, 12 mm. long, the stigma minute, subcapitate.

The only authentic material available for this study is a sterile representative of the type, deposited in the United States National Herbarium. It has been necessary to rely, to a great extent, upon the original description by Merrill.

Features of distinction appear to be: (1) the five-celled ovary; (2) the glabrous style, 12 mm. long; (3) the pubescent filaments, 4 mm. long;

(4) the large corolla-lobes, 18 mm. long, pubescent on the external surfaces; and (5) the glabrous, subequal calyx-lobes, 7–10 mm. long, 7–8 mm. wide.

Very closely allied, and perhaps conspecific with it, is *A. apoensis* Elmer from Mindanao. However, until more material is available for study, I prefer to retain them both as species.

The five-celled ovary is found only in two other species, namely *A. luzonica* Merrill and *A. apoensis*. In the former species, the ovary, style, calyx-lobes, bracteoles and pedicel are covered with a dense, canescent pubescence which makes separation quite easy.

27. *Adinandra apoensis* Elmer, Leaf. Philipp. Bot. 8: 2833. 1915, "apoense." — Melchior in Nat. Pflanzenfam. ed. 2, 21: 144. 1925.

*Adinandra Merrillii* Elmer, in op. cit. 2834. — Melchior, loc. cit.

DISTRIBUTION: Mindanao (Davao, Agusan).

MINDANAO: Davao: Todaya, Mt. Apo, *A. D. E. Elmer 11265* (ISOTYPES, A, C, G, M, NY, US), Aug. 1909. — Mt. McKinley, *R. Kanehira 2704* (NY), Aug. 1930. Agusan: Cabadbaran, Mt. Urdaneta, *A. D. E. Elmer 14088* (ISOTYPES of *A. Merrillii*, A, C, G, M, NY, US), Oct. 1912.

Tree ca. 15 m. high; branchlets terete, relatively short and numerous, grayish, the terminal bud appressed-pubescent. Leaves coriaceous, glabrous, elliptic-oblong, 5–9 cm. long, 2.5–4 cm. wide, broadly rounded or obtuse at the apex, occasionally slightly emarginate, cuneate at the base, the margin crenately serrate towards the apex, entire towards the base, the veins 7–8 pairs, the primary veins evident on both surfaces, the reticulations prominent on the lower surface only, the petiole glabrous, ca. 5 mm. long. Flowers axillary, solitary; pedicel 1–1.5 cm. long, stout, glabrous, recurved; bracteoles 2, persistent, glabrous, opposite, immediately below the calyx, unequal, 1.5–2 mm. long, 2.5–3 mm. wide, broadly rounded, lightly glandular-denticulate along the margin; calyx-lobes 5, imbricate, glabrous, unequal, thickened at the base, broadly ovate to rounded, 8–9 mm. long, 7–8 mm. wide, the margins quite entire; corolla-lobes 5, connate at the base, obtuse at the apex, ca. 13 mm. long, 8–10 mm. wide, pubescent on the median portion of the external surface; stamens ca. 35, unequal in length, 6–11 mm. long, probably seriate, the filaments 2–7 mm. long, joined at the base only and adnate to the corolla, very hirsute, the anthers usually ca. 4 mm. long, occasionally shorter, apiculate, equally hirsute; ovary glabrous, globose (not conical), 5-celled, multi-ovulate, the style terete, entire, glabrous, 1.5 cm. long, rising abruptly from the ovary, not tapering. Fruit not seen.

This species appears very distinct from *A. leytenensis* Merrill, with which it formerly was considered synonymous. In *A. apoensis*, the style is easily 1.5 cm. long, and rises abruptly from a globose, 5-celled glabrous ovary. In *A. leytenensis* the style is only 7 mm. long, approximately one-half as long as that found in *A. apoensis*, and it tapers gradually from a conical 3-celled ovary.

The leaves in *A. leytenensis* have ca. 12 pairs of veins and the reticulations on the under surface are very distinct. Also the calyx-lobes are wider than long, very rounded at the apex and measure  $5 \times 6$ –6.5 mm. In *A. apoensis* there are only ca. 7 or 8 pairs of veins and the reticulations,



although obvious, are less conspicuous. The calyx-lobes are broadly ovate, longer than broad, and measure  $8-9 \times 7-8$  mm.

Cited here as a synonym is *A. Merrillii* Elmer. Having studied the types of both species, I can see no differences separating the two. Elmer mentions in the original description of *A. Merrillii* that the ovary was "very lightly woolly." The material was very sparse, hence only a single ovary was studied. This appears to be glabrous and five-celled. No mention of the number of ovary-cells was made in the original description. Elmer also refers to the number of stamens as "3". This undoubtedly is a typographical error. An accurate count could not be made from the very poor specimen I examined. However, the number appears to be 30 or more.

The closest relative appears to be *A. nigro-punctata* Merril. So far, material of *A. apoensis* has been collected only from Mindanao. *Adinandra nigro-punctata* seems to have been collected only once, from the type locality in Luzon. Future collections may show additional distinguishing characters.

VERNACULAR NAMES: *Malagsam* (Bagóbo), *Sañgnanan* (Monóbo).

#### EXCLUDED SPECIES

*Cleyera japonica* Thunberg emend, Sieb. & Zucc. var. *montana* (Merrill), comb. nov.

*Adinandra montana* Merrill in Philipp. Jour. Sci. Bot. 5: 363. 1910; Enum. Philipp.

Fl. Plts. 3: 73. 1923. — Melchior in Nat. Pflanzenfam. ed. 2, 21: 144. 1925. Not *A. montana* Ridley (1915).

DISTRIBUTION: Luzon (Benguet, Cagayan, Camarines, Ilocos Norte, Laguna, Nueva Ecija, Nueva Viscaya, Rizal, Tayabas), Mindanao (Bukidnon, Davao, Misamis).

LUZON: Prov. Benguet: Mt. Pulog, *H. M. Curran, M. L. Merritt & T. C. Zschokke* [P.B.F.] 18149 (US), Jan. 1909. — "Haights in the Oaks," alt. 2300 m., *E. A. Mearns* [P.B.S.] 4420 (US), July 1907. — Pauai, *J. K. Santos* [P.B.S.] 31932 (NY), April-June 1918. — Mt. Baudan, *M. Ramos & G. Edaño* [P.B.S.] 40314 (A, US), Sept. 1921. — Mt. Pulog, *M. Ramos & G. Edaño* [P.B.S.] 44906 (A, NY), Feb.-March 1925. Prov. Cagayan: Mt. Dos Cuernos, along streams near the foot of the mt., alt. 1000 m., *M. Ramos* [P.B.S.] 76995 (A), April 26, 1929, (3-6 m. high). — Mt. Tabuan, on ridges of slopes, alt. 2000 m., *M. Ramos* [P.B.S.] 77107 (A), May 19, 1929 (4 m. high; flowers whitish yellow). Prov. Camarines: *M. Ramos* 1587 (M, NY), Dec. 1913. Prov. Ilocos Norte: Mt. Palimbin, *M. Ramos* [P.B.S.] 33318 (A, US), Aug. 1918. Prov. Laguna: Mt. Cristobal, *F. Canicosa* [P.B.F.] 28980 (A), March 1922. — Mt. Bonahin, moist ridge, alt. 1350 m., *T. Fajatin* [P.B.F.] 31116 (NY), April 4, 1929 (tree 10 m. high; flowers white). Prov. Nueva Ecija: *R. J. Alvarez* [P.B.F.] 22191 (US), Dec. 1910. — Mt. Umingan, *M. Ramos & G. Edaño* [P.B.S.] 26255 (A, US), Aug.-Sept. 1916. Prov. Nueva Viscaya: Mt. Alzapan, *M. Ramos & G. Edaño* [P.B.S.] 45623 (NY), May-June 1925. Prov. Rizal: Montalban, *A. Loher* 12346 (A), Oct. 1909. — Mt. Lumutan, *M. Ramos* [P.B.S.] 42298 (M), April 1923. Prov. Tayabas: Mt. Camatis, *Alcasir & G. Edaño* 4513 (A), 4487 (A), May 1939. — *F. Canicosa* [P.B.F.] 30017 (US), April 1925. — *H. M. Curran & M. L. Merritt* [P.B.F.] 7846 (US), Nov. 1907.

MINDANAO: Prov. Bukidnon: Mt. Lipa, *M. Ramos & G. Edaño* [P.B.S.] 38493 (A), June-July 1920. — Mt. Candoon, *M. Ramos & G. Edaño* [P.B.S.] 38933 (A, US), June-July 1920. — Vicinity of Tanculan, *E. Fenix* [P.B.S.] 26063 (A, US), July 1916. Prov. Davao: Mt. Colelan, forested ridge, alt. 1900 m., *A. D. E. Elmer* 10620 (A, C, G, M, NY, US), May 1909. — Todaya, Mt. Apo, wooded ridge,

alt. 2300 m., *A. D. E. Elmer 11465* (A, C, M, NY, US), Aug. 1909. Prov. Misamis: Mt. Matindang, *E. A. Mearns & W. I. Hutchinson* [P.B.F.] 4558 (ISOTYPES of *A. montana*, M, NY, US), May 1906.

Small tree 4–10 m. high; branchlets terete, reddish brown, glabrous even to the very young growth, including the terminal buds. Leaves coriaceous, glabrous, elliptic-ovate to elliptic-oblong, 5–8 (–10) cm. long, 2–3.5 (–4) cm. wide, usually more or less acuminate at the apex, sometimes blunt and shortly so, acute at the base, the margin entire, somewhat revolute in drying, the veins generally obscure, occasionally faintly visible on the upper surface, the petiole 5–10 mm. long, glabrous. Flowers axillary, up to 5 in an axil, sometimes solitary; pedicel stout, usually 1–2 cm. long, occasionally slightly shorter, glabrous; bracteoles 2, opposite or alternate, quickly caducous, when present minute, quite scale-like, deltoid, ca. 1–1.5 mm. long; calyx-lobes 5, imbricate, glabrous, unequal ca. 3 mm. long, sometimes shorter, ca. 3 mm. wide, fimbriate-ciliolate along the margin, the outer lobes abruptly apiculate, the inner lobes more rounded; corolla-lobes 5, glabrous, obovate to narrowly obovate, 9–12 mm. long, 4–5 mm. wide; stamens ca. 25, unequal in length, 4–7 mm. long, the filaments glabrous, adnate to the base of the corolla, sometimes appearing free, the anthers ca. 1 mm. long, very slightly retrorse-pilose; ovary glabrous, 3-celled, tapering into a glabrous style which is usually 3-parted, sometimes slightly so, occasionally incompletely so, topped by three stigmas. Fruit ovoid to globose, glabrous, three-celled, sometimes incompletely so, ca. 1 cm. diam.; the seeds minute, brown, varying in number.

This is the first record of the genus *Cleyera* from the Philippine Islands. Described originally under *Adinandra*, this new variety of *Cleyera japonica* Thunb. has been collected profusely in many provinces of Luzon and Mindanao.

The axial placentation of the ovary, the retrorse pubescence of the anthers, the entire leaves and glabrous terminal buds, the 3-parted style and 3-celled ovary, and the very small, subrotund, conspicuously ciliolate calyx-lobes are characteristics of *Cleyera* rather than *Adinandra*.

There is considerable variation in the parts of the flower but none appear consistent enough for specific delimitation. Ordinarily the calyx-lobes are approximately 3 mm. long and about as wide. In *Curran & Merritt 7846* and *Canicosa 30017* from Tayabas, *Loher 12346* from Benguet and *Canicosa 28980* from Laguna Province in Luzon the calyx-lobes are smaller, measuring only 2 mm. in length and width. However, in *Mearns 4420* and *Ramos & Edaño 44906* from Mt. Pulog, Benguet Province, the calyx-lobes measure 2.7 mm. and 3.5–4 mm. respectively.

There is also variation in the pedicel-length and the size of the leaf. Ordinarily, the pedicel measures 1.5–2 cm. long. In the first two specimens mentioned above, namely *Curran & Merritt 7846* and *Canicosa 30017*, the pedicel measures only 7 mm. These two specimens are generally smaller in most characters. In *Ramos & Edaño 40314* from Mt. Baudan, Benguet Prov., the calyx-lobes are 2 mm. long but the pedicel measures 2 cm. *Ramos & Edaño 44906* from Mt. Pulog has pedicels measuring 2 cm. in length.

In the original description, no mention is made of the three-parted style and the fact that more than one flower is usually found in the axil. The degree of splitting in the style is variable. Entire styles and three-parted styles in varied stages may be found on the same specimen. However, the tendency to split is evident in all specimens. Also, the presence of more than one flower (up to five) is more prevalent than the solitary flower in the axil. These are all characters of typical *Cleyera*.

VERNACULAR NAMES: *Abu-abu*, *paniasan*.

*Ternstroemia urdanetensis* (Elmer), comb. nov.

*Adinandra urdanetensis* Elmer, Leaf. Philipp. Bot. 8: 2837. 1915 "urdanetense." — Merrill, Enum. Philipp. Fl. Plts. 3: 73. 1923.

*Ternstroemia epiphytica* Elmer ex Merrill, Enum. Philipp. Fl. Plts. 3: 73. 1923, in syn.

DISTRIBUTION: Mindanao, Luzon.

MINDANAO: Agusan: Cabadbaran, Mt. Urdaneta, *A. D. E. Elmer* 14078 (ISOTYPES of *A. urdanetensis*, A, C, G, M, US), Oct. 1912. LUZON: Prov. Sorsogon: Irosin, Mt. Bulusan, *A. D. E. Elmer* 15851 (A, NY, US), 17317 (A, NY, US), April & Sept. 1916. — Bulusan Volcano, *M. Ramos* [P.B.S.] 23671 (A, C, NY, US), Sept. 1915.

This species of *Ternstroemia* was first described as *Adinandra urdanetensis* by Elmer. Later, Elmer gave it the herbarium name *T. epiphytica*, which name Merrill, probably not realizing the relationship with *A. urdanetensis*, published in his Enumeration.

#### INDO-MALAYSIAN SPECIES

In this group are classified the species found in East Bengal, Ceylon, Siam, the Malay Peninsula, the Netherlands East Indies, Sarawak, and British North Borneo. Including the thirteen new species proposed here, there have been fifty-two species described under *Adinandra* which fall in this geographical group. Of these, twenty-four are recognized below, two are excluded from the genus, two are recorded as doubtful species and three are listed as little known.

It is with regret that I list species as "doubtful" or "little known." Material of these species can surely be found in the herbaria of Malaya and the Netherlands East Indies, perhaps in abundance — but at present, under the strict shipping conditions in the Pacific area, the material is not available for this study. As a result of the war some of the material may never be available.

Because of the lack of this material, my interpretations of some of the species of this group may be open to question. In too many instances it has been necessary to draw conclusions from a single specimen, often incomplete at that. In other cases decisions have been reached and the original descriptions only recorded when no material has been available at all. This information has been gathered, often very laboriously, from literature which appears annoyingly incomplete according to our present standards and which could apply easily to almost any species previously described. However precarious as it may be, I have attempted to bring



together the species of this geographical group which are presented below.

In this geographical area is found the true center of distribution of the genus. Species are much more varied in form than those of the Philippine Islands and Eastern Asia. Also, the number of species is considerably greater.

As in the two former groups, I am recording a chart, compiled during this study, which brings together the characters most used in identification, and under these headings have listed the respective species.

# CHART FOR INDO-MALAYSIAN SPECIES OF ADINANDRA

Bracteoles		Calyx-lobes	
PERSISTENT	CADUCOUS	PUBESCENT	GLABROUS
<i>acuminata</i>	<i>borneensis</i>	<i>acuminata</i>	<i>angulata</i>
<i>angulata</i>	<i>coarctata</i>	<i>borneensis</i>	<i>Brefeldii</i>
<i>Brefeldii</i>	<i>dasyantha</i>	<i>caudatifolia</i>	<i>celebica</i>
<i>caudatifolia</i>	<i>Griffithii</i>	<i>Clemensiae</i>	<i>collina</i>
<i>celebica</i>	<i>javanica</i>	<i>coarctata</i>	<i>dumosa</i>
<i>Clemensiae</i>	<i>lutescens</i>	<i>colombonensis</i>	<i>excelsa</i>
<i>colombonensis</i>	<i>myrioneura</i>	<i>cordifolia</i>	<i>Griffithii</i>
<i>collina</i>	<i>oblonga</i>	<i>cordifolia</i>	<i>impressa</i>
<i>cordifolia</i>	<i>phlebophylla</i>	<i>strigosa</i>	<i>polyneura</i>
<i>cordifolia</i>	<i>plagiobasis</i>	<i>Corneriana</i>	<i>quinquepartita</i>
<i>strigosa</i>	<i>villosa</i>	<i>dasyantha</i>	<i>Sarosanthera</i>
<i>Corneriana</i>		<i>Hullettii</i>	<i>verrucosa</i>
<i>dumosa</i>		<i>integerrima</i>	
<i>excelsa</i>		<i>javanica</i>	
<i>Hullettii</i>		<i>lasioptala</i>	
<i>impressa</i>		<i>lutescens</i>	
<i>integerrima</i>		<i>maculosa</i>	
<i>lasioptala</i>		<i>magniflora</i>	
<i>maculosa</i>		<i>myrioneura</i>	
<i>magniflora</i>		<i>nunkokensis</i>	
<i>nunkokensis</i>		<i>oblonga</i>	
<i>parvifolia</i>		<i>parvifolia</i>	
<i>polyneura</i>		<i>plagiobasis</i>	
<i>quinquepartita</i>		<i>phlebophylla</i>	
<i>Sarosanthera</i>		<i>subsessilis</i>	
<i>subsessilis</i>		<i>villosa</i>	
<i>verrucosa</i>			
Corolla-lobes		Filaments	
PUBESCENT	GLABROUS	PUBESCENT	GLABROUS
<i>acuminata</i>	<i>angulata</i>	<i>acuminata</i>	<i>angulata</i>
<i>borneensis</i>	<i>Clemensiae</i>	<i>borneensis</i>	<i>dasyantha</i>
<i>Corneriana</i>	<i>collina</i>	<i>Clemensiae</i>	<i>excelsa</i>
<i>dasyantha</i>	<i>colombonensis</i>	<i>collina</i>	<i>impressa</i>

Corolla-lobes (Continued)		Filaments (Continued)	
PUBESCENT	GLABROUS	PUBESCENT	GLABROUS
<i>integerrima</i>	<i>cordifolia</i>	<i>colombonensis</i>	<i>javanica</i>
<i>javanica</i>	<i>cordifolia</i>	<i>cordifolia</i>	<i>maculosa</i>
<i>lasiopectala</i>	<i>strigosa</i>	<i>cordifolia</i>	<i>oblonga</i>
<i>lutescens</i>	<i>dumosa</i>	<i>strigosa</i>	<i>phlebophylla</i>
<i>myrioneura</i>	<i>excelsa</i>	<i>Corneriana</i>	<i>Sarosanthera</i>
<i>nunkokensis</i>	<i>Griffithii</i>	<i>dumosa</i>	
<i>oblonga</i>	<i>Hullettii</i>	<i>Hullettii</i>	
<i>parvifolia</i>	<i>impressa</i>	<i>integerrima</i>	
<i>plagiobasis</i>	<i>maculosa</i>	<i>lasiopectala</i>	
<i>phlebophylla</i>	<i>magniflora</i>	<i>lutescens</i>	
<i>polyneura</i>	<i>quinquepartita</i>	<i>magniflora</i>	
<i>subsessilis</i>	<i>Sarosanthera</i>	<i>myrioneura</i>	
<i>villosa</i>	<i>verrucosa</i>	<i>nunkokensis</i>	
		<i>parvifolia</i>	
		<i>plagiobasis</i>	
		<i>polyneura</i>	
		<i>quinquepartita</i>	
		<i>subsessilis</i>	
		<i>verrucosa</i>	
		<i>villosa</i>	
Ovary		Style	
PUBESCENT	GLABROUS	PUBESCENT	GLABROUS
<i>acuminata</i>	<i>angulata</i>	<i>acuminata</i>	<i>angulata</i>
<i>borneensis</i>	<i>Brefeldii</i>	<i>caudatifolia</i>	<i>borneensis</i>
<i>caudatifolia</i>	<i>celebica</i>	<i>Clemensiae</i>	<i>Brefeldii</i>
<i>Clemensiae</i>	<i>colombonensis</i>	<i>coarctata</i>	<i>celebica</i>
<i>coarctata</i>	<i>dumosa</i>	<i>collina</i>	<i>colombonensis</i>
<i>collina</i>	<i>excelsa</i>	<i>Corneriana</i>	<i>cordifolia</i>
<i>cordifolia</i>	<i>Griffithii</i>	<i>integerrima</i>	<i>cordifolia</i>
<i>cordifolia</i>	<i>impressa</i>	<i>javanica</i>	<i>strigosa</i>
<i>strigosa</i>	<i>lasiopectala</i>	<i>lutescens</i>	<i>dasyantha</i>
<i>Corneriana</i>	<i>polyneura</i>	<i>magniflora</i>	<i>dumosa</i>
<i>dasyantha</i>	<i>quinquepartita</i>	<i>nunkokensis</i>	<i>excelsa</i>
<i>Hullettii</i>	<i>Sarosanthera</i>	<i>oblonga</i>	<i>Griffithii</i>
<i>integerrima</i>	<i>verrucosa</i>	<i>phlebophylla</i>	<i>Hullettii</i>
<i>javanica</i>		<i>villosa</i>	<i>impressa</i>
<i>lutescens</i>			<i>lasiopectala</i>
<i>maculosa</i>			<i>maculosa</i>
<i>magniflora</i>			<i>myrioneura</i>
<i>myrioneura</i>			<i>plagiobasis</i>
<i>nunkokensis</i>			<i>polyneura</i>
<i>oblonga</i>			<i>quinquepartita</i>
<i>phlebophylla</i>			<i>Sarosanthera</i>
<i>parvifolia</i>			<i>subsessilis</i>
<i>plagiobasis</i>			<i>verrucosa</i>
<i>Sarosanthera</i>			
<i>subsessilis</i>			
<i>villosa</i>			

## Ovary

FIVE-CELLED	FOUR-CELLED	THREE-CELLED	TWO-CELLED
<i>borneensis</i>	<i>myrioneura</i>	<i>acuminata</i>	<i>nunkokensis</i>
<i>celebica</i>	<i>oblonga</i>	<i>angulata</i>	<i>subsessilis</i>
<i>Clemensiae</i>		<i>caudatifolia</i>	
<i>coarctata</i>		<i>Corneriana</i>	
<i>collina</i>		<i>javanica</i>	
<i>colombonensis</i>		<i>lasio petala</i>	
<i>cordifolia</i>		<i>lutescens</i>	
<i>cordifolia</i>		<i>Sarosanthera</i>	
<i>strigosa</i>			
<i>dasyantha</i>			
<i>dumosa</i>			
<i>Griffithii</i>			
<i>Hullettii</i>			
<i>impressa</i>			
<i>integerrima</i>			
<i>maculosa</i>			
<i>magniflora</i>			
<i>parvifolia</i>			
<i>plagiobasis</i>			
<i>polyneura</i>			
<i>quinquepartita</i>			
<i>verrucosa</i>			
<i>villosa</i>			

## KEY TO THE INDO-MALAYSIAN SPECIES

## A. Ovary and fruit glabrous.

## B. Stigma 3- or 5-parted; style 3- or 5-parted or deeply sulcate.

## C. Ovary and fruit 5-celled; stigma and style 5-parted or sulcate.

D. Bracteoles caducous or vestigial. (Bengal).....28. *A. Griffithii*.

## DD. Bracteoles persistent.

E. Leaves 9-17 cm. long, 4.5-7.5 cm. wide; veins of mature leaves inconspicuous on upper surface, not impressed; anthers hirsute. (British North Borneo: Mt. Kinabalu)....29. *A. quinquepartita*.

EE. Leaves 4-7 cm. long, 2.5-4 cm. wide; veins of mature leaves impressed above; anthers glabrous except for rare isolated setae. (British North Borneo: Mt. Kinabalu).....30. *A. impressa*.

CC. Ovary and fruit 3-celled; stigma and style 3-parted. (Ceylon).....  
.....31. *A. lasio petala*.

## BB. Stigma and style entire.

C. Ovary and fruit 5-celled; ovules many; seeds small (2-3 mm. long), many developing.

## D. Terminal buds glabrous.

E. Pedicels slender, up to 20 mm. long; leaves with midrib smooth beneath, the blade not punctate-dotted (Malay Peninsula; East Indies).....32. *A. dumosa*.

EE. Pedicels short and thick, 5 mm. long and ca. 3 mm. thick; leaves with midrib bisulcate beneath, the blade dark punctate-dotted. (British North Borneo: Mt. Kinabalu).....33. *A. verrucosa*.

## DD. Terminal buds appressed-pubescent.

E. Corolla-lobes glabrous; veins conspicuous up to 12 pairs, arcuate-ascending near the margin.

F. Calyx-lobes pubescent; filaments pubescent; leaves 6-10 cm. long, 3-4 cm. wide, the base attenuate. (British North Borneo: Mt. Kinabalu).....34. *A. colombonensis*.



- FF. Calyx-lobes glabrous; filaments glabrous; leaves 9–15 cm. long, 4–6.5 cm. wide, the base rounded or obtuse. (British North Borneo).....35. *A. excelsa*.
- EE. Corolla-lobes pubescent; veins conspicuous, more than 20 pairs, becoming evanescent towards the margin, not arcuate-ascending. (Borneo).....36. *A. polyneura*.
- CC. Ovary and fruit 3-celled; ovules few in number; seeds large (6–8 mm. long), few (6–8) developing.
- D. Leaves heavily coriaceous, the veins conspicuously elevated on both surfaces with equally conspicuous reticulations; bracteoles minute, deltoid, apiculate; branches always winged. (Pahang).....37. *A. angulata*.
- DD. Leaves coriaceous, the veins inconspicuous above, more pronounced beneath without obvious reticulations; bracteoles small, rounded at the apex; young branchlets usually terete, rarely winged or angled, the branches always terete. (Malay Peninsula; Sumatra, Java, Borneo)...38. *A. Sarosanthera*.
- AA. Ovary pubescent; fruit pubescent or glabrescent, usually with a few hairs at the apex.
- B. Bracteoles persistent through fruiting stage.
- C. Leaves cordate at the base.
- D. Mature leaves glabrous on the lower surface. (Sarawak; British North Borneo).....39. *A. cordifolia*.
- DD. Mature leaves scabrous-pubescent on the lower surface. (British North Borneo: Mt. Kinabalu).....39a. *A. cordifolia* var. *strigosa*.
- CC. Leaves cuneate, obtuse or rounded at the base, not cordate.
- D. Style glabrous.
- E. Corolla pubescent.
- F. Leaves subsessile, the petiole 1–2 mm. long; pedicel very short, 1–2 mm. long; ovary 2-celled, pauci-ovulate; fruit with few (ca. 2) seeds developing, seeds large up to 8 mm. long. (Sarawak)....40. *A. subsessilis*.
- FF. Leaves petiolate, the petiole 5–7 mm. long; pedicel ca. 10 mm. long; ovary 5-celled, multi-ovulate; fruit with many (over 100) seeds developing, seeds small (2–3 mm.). (Malay Peninsula)....41. *A. parvifolia*.
- EE. Corolla glabrous.
- F. Ovary 3-celled, pauci-ovulate; fruit 3-celled, few (10 or less) seeded, the seeds large, up to 8 mm. long. (Malay Peninsula; Sumatra, Java, Borneo).....38. *A. Sarosanthera*.
- FF. Ovary 5-celled, multi-ovulate; fruit 5-celled, many (over 100) seeded, the seeds small (2–3 mm. long).
- G. Bracteoles densely pubescent, broadly ovate or deltoid, unequal (5 × 5 mm. and 3 × 3 mm.); branchlets rusty-tomentose; terminal buds densely tawny-sericeous. (Malay Peninsula).....42. *A. Hullettii*.
- GG. Bracteoles appressed-pubescent, subrotund, unequal (2 and 3 mm. long); branchlets appressed-pubescent near the apex; terminal buds appressed-pubescent. (Malay Peninsula).....43. *A. maculosa*.
- DD. Style pubescent.
- E. Corolla pubescent.
- F. Ovary 3- or 2-celled, pauci-ovulate, the ovules large; fruit 3- or 2-celled, few seeded (less than 10), the seeds up to 8 mm. long.
- G. Pedicels short and thick, 5 mm. long, 4 mm. in diameter; ovary and fruit 2-celled. (British North Borneo: Mt. Kinabalu).....44. *A. nunkokensis*.

- GG. Pedicels usually over 10 mm. long, up to 20 mm.; ovary and fruit 3-celled.
- H. Branchlets, lower surface of leaves, pedicels, and bracteoles densely ferrugineous-sericeous; fruit with single seed to each cell. (Malay Peninsula).....45. *A. Corneriana*.
- HH. Branchlets, lower surface of the leaves (when pubescent) and other parts lightly appressed-pubescent; fruit with more than a single seed (ca. 3) to each cell.
- I. Leaves chartaceous, 5-8 mm. long, 2.5-3.5 mm. wide, nearly flask-shaped, long-caudate at the apex; seeds dark, shining. (British North Borneo: Mt. Kinabalu).  
.....46. *A. caudatifolia*.
- II. Leaves coriaceous, up to 15 cm. long, 4-6 cm. wide, acuminate at the apex; seeds light buff, dull. (Malay Peninsula; Malacca; Sumatra).....47. *A. acuminata*.
- FF. Ovary 5-celled, multi-ovulate, the ovules minute; fruit 5-celled, many (100 or more) seeded, the seeds measuring ca. 3 mm. long. (Malay Peninsula).....48. *A. integerrima*.
- EE. Corolla glabrous.
- F. Terminal buds glabrous; midrib on the lower surface of the leaf bisulcate; calyx-lobes glabrous. (Sarawak, British North Borneo, Borneo).....49. *A. collina*.
- FF. Terminal buds sericeous or appressed-pubescent; midrib on the lower surface of the leaf rounded, not bisulcate; calyx-lobes pubescent.
- G. Small leaves, 3-5 cm. long, 2-2.5 cm. wide, occasionally larger; bracteoles ca. 2 mm. long; corolla-lobes always five; seeds minute, ca. 2 mm. long, dark, shining. (British North Borneo: Mt. Kinabalu).....50. *A. Clemensiae*.
- GG. Leaves larger, 6-13 cm. long, 4-7 cm. wide; bracteoles 5-6 mm. long, 6-8 mm. wide; corolla-lobes six in number; seeds minute, 1.5 mm. or less, red in color. (British North Borneo).  
.....51. *A. magniflora*.
- BB. Bracteoles quickly caducous, seldom lasting to anthesis.
- C. Leaves obliquely cordate at base. (Sarawak).....52. *A. plagiobasis*.
- CC. Leaves acute or subrotund, never cordate.
- D. Style glabrous.
- E. Bracteoles persistent. (Southeast Borneo).....53. *A. borneensis*.
- EE. Bracteoles caducous.
- F. Filaments glabrous; veins up to 20 pairs, rather inconspicuous on the lower surface of the leaf, extending from the midrib at an angle of 60°. (Sumatra).....54. *A. dasyantha*.
- FF. Filaments pubescent; veins over 25 pairs, conspicuous on the lower surface of the leaf, approximately perpendicular to the midrib. (British North Borneo).....55. *A. myrioneura*.
- DD. Style pubescent.
- E. Ovary and fruit 3-celled.
- F. Bracteoles alternate (evident by scars when the bracteoles have fallen) with the lower bracteole as much as 5 mm. below the calyx; apicule on the stamen not distinctive; leaves heavily coriaceous. (Java).....56. *A. javanica*.
- FF. Bracteoles opposite (scars), immediately below calyx; apicule of the stamen 3 mm. long equalling the anther in length; leaves subcoriaceous. (Siam).....57. *A. lutescens*.
- EE. Ovary and fruit 5-celled (or 4-celled in *A. oblonga*).
- F. Stigma 4-parted, oblique; ovary and fruit 4-celled. (Siam).....  
.....58. *A. oblonga*.

FF. Stigma entire; ovary and fruit 5-celled.

G. Pedicels very short, ca. 5 mm. long. (Siam).....59. *A. coarctata*.

GG. Pedicels 10-50 mm. long.

H. Filaments glabrous; calyx-lobes distinctly acute at the apex. (Indo-China).....60. *A. phlebophylla*.

HH. Filaments sericeous; calyx-lobes rounded at the apex. (Malay Peninsula; Burma).....61. *A. villosa*.

28. *Adinandra Griffithii* Dyer in Hooker f., Fl. Brit. Ind. 1: 282. 1874. — Szyszyłowicz in Nat. Pflanzenfam. III. 6: 189. 1893. — Melchior in Nat. Pflanzenfam. ed. 2, 21: 144. 1925.

DISTRIBUTION: East Bengal.

EAST BENGAL: *W. Griffith 755* (ISOTYPE, G).

Tree 15-20 m. with slightly angled branchlets, the branchlets glabrous even to the younger growth, the terminal buds glabrous. Leaves coriaceous, oblong-elliptic to oblong-ob lanceolate, 12-15 cm. long, 4-5 cm. wide, acuminate at the apex, tapering at the base, glabrous on both surfaces, even in the very young leaves, the margin quite entire, the veins rather inconspicuous, the petioles sturdy, glabrous, semi-terete, flattened above. Flowers axillary, solitary; pedicels ca. 2 cm. long, glabrous; bracteoles 2, caducous or vestigial; calyx-lobes 5, imbricate, glabrous, rounded, ca. 8 mm. long; corolla-lobes (fide Dyer) equalling the calyx-lobes in length; stamens (fide Dyer) sparingly setose, 1-seriate, adnate to the base of the corolla; ovary glabrous, tapering into the style, the style glabrous, distinctly 5-fid, the divisions of the style cylindrical, hardly exceeding the calyx-lobes. Fruit not seen.

The above description of this species is not as complete as one might desire. Although an isotype of the species has been available for this study, little additional information can be given at present.

The outstanding feature of the species is the deeply five-parted style. In the majority of species of *Adinandra* the style is entire for the whole length. The only other known exception is *A. lasiopetala* (Wight) Choisy in which the style is three-parted. In *A. impressa* Kob. and *A. quinquepartita* Kob. dissections made from buds show the style to be five-sulcate.

The ovary of *A. Griffithii* is undoubtedly five-celled, although not mentioned as such by Dyer. Also one may assume that the corolla-lobes are glabrous on the external surface, because, were they pubescent, Dyer would have drawn attention to the fact, since he does describe the corolla. Dyer states that the bracteoles are vestigial. Observing them, I cannot be certain whether they are vestigial or caducous. I am inclined toward the latter.

A specimen deposited in the U. S. National Herbarium at Washington may be mentioned here. This specimen, collected by *Dr. King's Collector*, no. 114, is incomplete. However, in an accompanying packet is material from previous dissections of buds showing the style definitely five-parted. The leaves are glabrous, as in the terminal bud, and the branchlets are slightly angled. The leaves are larger and less coriaceous than those of the type, measuring up to 20 cm. in length and 6.5 cm. in width.

This additional specimen collected in the "Akha Hills" is recorded from



Duffla Hill as a "tree 50 to 60 ft. high, 3 to 4 ft. in dt.; leaves green, flowers white." It was collected in Feb. 1890. The actual collector's name is not clear but appears to be "Khan." This locality, Akla Hills, or Aka Hills, as it is recorded in some gazetteers, is on the northeastern frontier of India, northeast of the Darrang District of Eastern Bengal. Duffla Hill is also recorded as Daffla Hill. Aka and Daffla are names of independent tribes. This locality agrees very well with that of the type, *Griffith 755*, which was collected in East Bengal.

29. *Adinandra quinquepartita*, sp. nov.

Arbor parva; ramis glabris, teretibus, flavo-brunneis, subrugulosis, ramulis glabris, teretibus brunneis, gemmis terminalibus conicis, glabris. Folia crasso-coriacea, elliptico-oblonga vel ovata, 9–17 cm. longa, 4.5–7.5 cm. lata, apice acuta vel late acuminata, minute emarginata, basi late cuneata vel subrotundata, undique glabra, subtus fusco-punctata, margine subintegra vel minute glandulosa, venis lateralibus primariis 8–10 paribus, marginem versus inconspicuis, venis secundariis inter primarias frequentibus, petiolis crassis, glabris, 6–10 mm. longis, ad 4 mm. diametro. Flores axillares, solitarii; pedicellis 2–3.5 cm. longis, glabris, recurvatis; bracteolis 2, oppositis, persistentibus, glabris, ca. 3 mm. longis, margine ciliolatis; sepalis 5, imbricatis, glabris, late ovatis vel subrotundatis, ca. 8 mm. longis, margine scariosis; petalis glabris; staminibus in numero ordinariis, ?-seriatis, filamentis exteriore leviter pubescentibus, antheris oblongis, leviter hirsutis; ovario glabro, conico, 5-loculari, multi-ovulato; stylo insigni, glabro, apice leviter 5-sulcato; stigmatibus 5-partitis. Fructus ignotus.

DISTRIBUTION: British North Borneo.

BRITISH NORTH BORNEO: Mt. Kinabalu, Gurulau spur, in an open place, alt. 2100–2700 m., *J. & M. S. Clemens 50781* (TYPE, A), Dec. 6, 1933 (small tree; flowers white, the stigma 5-parted).

Unfortunately, complete material was unavailable for the study of this new species. In fact the material is so incomplete that, were it not for the unusually distinctive character of the pistil, I would have refrained from describing it as new.

The ovary is 5-celled, glabrous, and after swelling at the base tapers conically into an ill-defined style similar to those found in species of *Gordonia*. The style in the bud, which I examined, was undivided. However, the collectors, *J. & M. S. Clemens*, draw attention to the five divisions of the stigma and it is possible that, like *A. Griffithii* of India and *A. lasiopetala* of Ceylon the style in open flower and fruit may be divided. The stamens, although no accurate count could be obtained, were typically those of *Adinandra* in number and character. The anthers were oblong, elongated, and bore the characteristic pubescence of the genus. The filaments also were lightly pubescent, in series, and joined for part of their length. The corolla-lobes, very tightly folded in the bud, could not be separated. However, they were glabrous and of a more thickened nature than those found in *Gordonia*. The ovules were attached to a slight placenta.

The specific name *A. quinquepartita* refers to the 5-parted stigma.

30. *Adinandra impressa*, sp. nov.

Arbor ?; ramis griseis, teretibus, glabris, ramulis teretibus brunneis, glabris, innovationibus glabris vel rare leviter pubescentibus, gemmis terminalibus conicis glabris vel rarissime leviter adpresso-pubescentibus. Folia coriacea, glabra, oblongo-elliptica vel late elliptica, 4–7 cm. longa, 2.5–4 cm. lata, apice late acuminata, basi obtusa vel late cuneata, margine integra, supra nitida, subtus pallidiora, fusco-punctata, venis supra impressis, subtus subobscuris, primariis 5–8 paribus, intra marginem anastomosantibus arcuantibusque, venis secundariis inter primarias frequentibus, petiolis circiter 5 mm. longis, glabris. Flores axillares, solitarii; pedicellis glabris, teretibus, 1.5–2.5 cm. longis; bracteis 2, oppositis, glabris, subrotundatis, circiter 2 mm. longis et latis, margine glandulosis; sepalis 5, imbricatis, glabris, margine glandulosis, exterioribus duobus late deltoideis, 4 mm. longis, 6 mm. latis, interioribus tribus subrotundatis, circiter 5 mm. longis, 6 mm. latis; petalis 5, basi connatis, glabris, purpureis, circiter 12 mm. longis, apice acutis; staminibus circiter 25, 3-seriatis, glabris, filamentis pallidis, connatis, ad basi corollam adnatis, 3–5 mm. longis, antheris 2–3 mm. longis, glabris, rarissime setis isolatis, ovario glabro, semi-globoso, circiter 4 mm. diametro, 5-loculari, multi-ovulato, stylo glabro, circiter 5 mm. longo, apice 5-sulcato, stigmatibus 5. Fructus elongato-globosus, glaber, circiter 12 mm. longus, 8 mm. latus, 5-locularis, multi-seminatus, seminibus minutis, 1 mm. vel minus diametro, rubris.

DISTRIBUTION: British North Borneo.

BRITISH NORTH BORNEO: Upper Mt. Kinabalu, alt. 2000–5000 m., *J. & M. S. Clemens* 30202 (TYPE, A), April 1932 (flowers dark with purple petals and green calyx). — Upper Mt. Kinabalu, *J. & M. S. Clemens* 29073 (A), April 8, 1932 (flower-buds dark, the petals purple, the calyx green).

Like *A. quinquepartita* Kob. this species has distinctly five stigmas. The style near the apex is sulcate with five distinct ridges. Dissections were made from the bud. It is possible that in maturing the style may become five-parted. The corolla is dark purple in color, and in the bud it is very elongate-conical, extending considerably beyond the calyx. The stamens, except for a rare evidence of pubescence on the anthers, are glabrous throughout. The leaves are thick-coriaceous with impressed nerves on the upper surface. The terminal buds are generally glabrous. However, there are rare instances of pubescence on the buds and very young branchlets. In glabrosity this species rivals *A. dumosa* Jack. The mature seeds are minute, measuring a single millimeter or less in diameter, and are red in color rather than the traditional dark brown.

31. *Adinandra lasiopetala* (Wight) Choisy in Mém. Soc. Phys. Hist. Nat. Genève 1: 112 (Mém. Ternstr. 24). 1855. — Dyer in Hooker f., Fl. Brit. Ind. 1: 283. 1874. — Beddome, Fl. Sylv. 2: (Forester's Man. Bot. xxiv, t. iii, f. 3). 1874. — Szyszyłowicz in Nat. Pflanzenfam. III. 6: 189. 1893. — Trimen, Handb. Fl. Ceyl. 1: 108, pl. 9. 1893. — Melchior in Nat. Pflanzenfam. ed. 2, 21: 144. 1925.

*Cleyera lasiopetala* Wight, Ill. Ind. Bot. 1: 99. 1840.

*Eurya lasiopetala* (Wight) Gardner in Calcutta Jour. Nat. Hist. 7: 446. 1847.

*Sarosanthra lasiopetala* (Wight) Thwaites, Enum. Pl. Zeyl. 41. 1858.

DISTRIBUTION: Ceylon.

CEYLON: *G. H. K. Thwaites* 775 (G).

Small tree ca. 10 m. high; branchlets terete, grayish brown, glabrous except when very young. Leaves coriaceous, oblanceolate, glabrous except when very young, 7–9 cm. long, 2–3 cm. wide, the margin serrulate, conspicuously recurved especially along the lower half of the leaf, the petiole semi-terete, flat on the upper surface, ca. 5 mm. long. Flowers axillary, solitary; pedicels somewhat recurved, ca. 1.5 cm. long, appressed-pubescent, thickened towards the apex; bracteoles 2, unequal, opposite, immediately beneath the calyx, persistent, somewhat rotund, 3–5 mm. long, finely appressed-pubescent; calyx-lobes 5, imbricate, thickened, unequal, somewhat rotund, ca. 8 mm. long, the outer lobes finely appressed-pubescent, the inner lobes sericeous on the central portion of the outer surface, the margin glabrous, membranaceous; corolla-lobes 5, white, obtuse, ca. 2 cm. long, covered on the back with dense sericeous pubescence; stamens (fide Trimen et al.) monadelphous, 18–25, filaments unequal, sparsely hairy, joined at the base, the anthers sparsely pubescent; ovary 3-celled, glabrous, attenuate at the apex into a filiform, glabrous style which, on the maturing of the fruit, becomes 3-parted, the stigma 3-parted. Fruit globose, 3-celled, fide auct., many-, small-seeded; seeds hippocrepiform.

This species is exceptional in the genus in having a 3-parted style (in the maturing fruit), and small seeds. These characteristics are similar to those found in *Cleyera*. The persistent bracteoles, the single, axillary flowers and the pubescent filaments separate it, on the other hand, from *Cleyera*.

The only specimen available for this study is *Thwaites* (C. P. 775), quite an authentic specimen since it was used by Thwaites in his treatment. It agrees perfectly, as far as the available characters are concerned, with the illustrations of Trimen. The stamens were not seen by the present author, but the statement by Dyer that they are unequal leads one to believe that some form of seriate arrangement exists. Only in a single series are the stamens usually of equal length.

32. *Adinandra dumosa* Jack in Malay Misc. 2 (7): 50. 1822 [repr. in Hooker, Comp. Bot. Mag. 1: 153. 1835; in Calcutta Jour. Nat. Hist. 4: 207. 1843; et in Miscel. Papers Indo-China, II. 2: 271. 1887]. — Choisy in Zollinger, Syst. Verz. Ind. Archip. 143. 1854; in Mém. Soc. Phys. Hist. Nat. Genève, 1: 112 (Mém. Ternstr. 24). 1855. — Miquel, Fl. Ned. Ind. 1 (2): 477. 1859; Ann. Mus. Bot. Lugd.-Bat. 4: 103. 1868. — Dyer in Hooker f., Fl. Brit. Ind. 1: 282. 1874. — King in Jour. As. Soc. Bengal, 59 (2): 188 (Mater. Fl. Malay Penin. 1: 128). 1890. — Szyszyłowicz in Nat. Pflanzenfam. III. 6: 189. 1893. — Koorders & Valetton, Meded. 'S Lands. Pl. 16: 223 (Bijdr. Boomsort Java 3: 223). 1896. — Merrill, Enum. Born. Plts. 391. 1921. — Burkill & Holttum in Gard. Bull. Straits Settl. 3: 36. 1923. — Melchior in Nat. Pflanzenfam. ed. 2, 21: 144. 1925.
- Adinandra Jackiana* Korthals, Verh. Nat. Gesch. Bot. ed. Temminck, 106. 1840.
- Adinandra trichocoryna* Korthals, Verh. Nat. Gesch. Bot. ed. Temminck, 107. 1840. — Miquel, Fl. Ned. Ind. 1 (2): 477. 1859; Ann. Mus. Bot. Lugd.-Bat. 4: 103. 1868. — Merrill, Enum. Born. Plts. 391. 1921.
- Adinandra cyrtopoda* Miquel, Fl. Ned. Ind. Suppl. 1: 478. 1862.
- Adinandra stylosa* Miquel, Fl. Ned. Ind. Suppl. 1: 478. 1862.
- Adinandra glabra* Miquel, Fl. Ned. Ind. Suppl. 1: 479. 1862.
- Adinandra trichocoryna* Korthals  $\alpha$  *parvifolia* Miquel, Ann. Mus. Bot. Lugd.-Bat. 4: 103. 1868.
- Adinandra trichocoryna* Korthals  $\beta$  *glabra* Miquel, Ann. Mus. Bot. Lugd.-Bat. 4: 103. 1868.



*Adinandra trichocoryna* Korthals  $\gamma$  *stylosa* Miquel, Ann. Mus. Bot. Lugd.-Bat. 4: 104. 1868.

*Adinandra trichocoryna* Korthals  $\delta$  *cyrtopoda* Miquel, Ann. Mus. Bot. Lugd.-Bat. 4: 104. 1868.

DISTRIBUTION: Malay Peninsula, Netherlands East Indies, Sarawak, British North Borneo.

MALAY PENINSULA: Singapore, Bot. Garden, *J. & M. S. Clemens* 22448 (NY), Nov. 7, 1929 (tree 10 m. high; flowers white).—Singapore Bot. Gard. [Cult.], lawn l., *M. Nur* 3410 (A), Oct. 12, 1925, 24975 (A), May 17, 1930.—Singapore, *H. M. Curran* s. n. (US), Aug. 1910; *O. Kuntze* 6108 (NY), Oct. 1875.—Malacca, *W. Griffith* s. n. (G, M).—Perak, *B. Scortechini* s. n. (US).—Perak, near Ulu Selangore, open bamboo forest, hilly locale, alt. 150–200 m., *Dr. King's Collector* 8698 (A), March 1886 (tree 15 m. high with spreading branches; leaves dark metallic green; flowers white).—Penang, Penang Hill, *G. King* s. n. (U $\phi$ ), Aug. 1879.—Pahang, Tasek Bera, at low altitude, *M. R. Henderson* 24065 (NY), Oct. 10, 1930.—Exact locality lacking, *W. Griffith* 756 (G); *A. C. Maingay* 184 (G).

SUMATRA: East Coast: Asahan, Masihi Forest Reserve, in primary forests, on "red" soil, *B. A. Krukoff* 4255 (A, M, NY, US), Nov. 3, 1932 (tree 20 m. high).—Asahan, between Soenggapa and Pargambiran, alt. 270–360 m., *H. H. Bartlett* 6696 (C, NY, US), Feb. 11, 1927.—Koealoe, old jungle near the Aek Kanopan, Loendoet Concession, *H. H. Bartlett* 6989 (C, NY, US), March 19, 1927.—Asahan, between Soenggapa and Pargambiran, alt. 270–360 m., *H. H. Bartlett* 8061 (NY, US), May 22, 1927.—Asahan, Bandar Poeloch, *H. S. Yates* 1688 (A), 1917 (NY).—East southeast of Toba Lake, *J. A. Lorzing* 6563 (A), May 11, 1919.—Bilah, general region of Morbau, near Bilah Pertama (Parbasiram), *Rahmat Si Toroes* 389 (NY), Feb.-March 1928.—Koealoe, Si Toenggir, 9 km. from Damoeli, *Rahmat Si Toroes* 1894 (NY), Sept. 20, 1928.—Bilah, vicinity of Rantau Parapat, *Rahmat Si Toroes* 1577 (A), 2204 (A), March-May 1932 (tree).—Bilah, Aer Kandis (formerly Radja Mas), near Rantau Parapat, *Rahmat Si Toroes* 2666 (A, US), May 28-June 26, 1932 (tree).—Bilah, Sigamata, near Rantau Parapat, *Rahmat Si Toroes* 3125 (A, NY), June 27-July 23, 1932.—Bilah, Subdivision Laboeahan Batoe, District Kota Pinang, Lannga Pajoeng, *Rahmat Si Toroes* 3434 (NY, US), March 7–30, 1933.—Subdivision Laboeahan Batoe, District Kota Pinang, Si Mandi Angin (on the Soengei Kanan), *Rahmat Si Toroes* 4058 (A, NY, US), April-May 1933.—Subdivision Laboeahan Batoe, District Bilah, Hitean Haloban (South of Concession Rantau Parapat), *Rahmat Si Toroes* 4305 (US), May 17–24, 1933. Riouw en Onderh: Indragirischebovenlanden, Batang Peranap, alt. 75 m., *Neth. Ind. For. Serv. b.b.* 30092 (A), Sept. 19, 1939. Tapanoeli: Habinsaran, Panapparan to Maranti, *H. H. Bartlett* 8037 (NY, US), May 16–19, 1927.—Road from East Coast to Tapanoeli, northeast of Toba Lake, new road near Pese Pese, virgin jungle, alt. 1350–1500 m., *W. N. & C. M. Bangham* 1162 (A, NY), Feb. 22, 1932 (tree 8 m. high; flowers white).—Division Padang Si Dimpoean, Subdivision Padang Lawas, Sosopan on Aek Si Olip, *Rahmat Si Toroes* 5518 (A, NY), Sept. 1933. West Coast: "Sankor," *J. E. Teysmann* s. n. (G).—"Sibogne," *J. E. Teysmann* s. n. (G). Exact locality missing: *P. W. Korthals* s. n. (probable ISOTYPE of *A. Jackiana*, G, NY).—*H. O. Forbes* s. n. (G).

JAVA: *J. E. Teysmann* s. n. (probable ISOTYPES of *A. cyrtopoda*, G, NY), 1868.—*Herb. Hort. Buitenzorg* [Cult.] 137 (VI-c-203, 205, 205A) (US).

BORNEO: *J. E. Teysmann* s. n. (probable ISOTYPE of *A. stylosa*, G).—*P. W. Korthals* s. n. (probable ISOTYPE of *A. trichocoryna*, G, NY).

BRITISH NORTH BORNEO: Mt. Kinabalu, Mt. Nunkok, alt. 1650 m., *J. & M. S. Clemens* 32724 (A), April 15, 1933.—Mt. Kinabalu, Colombon River, alt. 1350 m., *J. & M. S. Clemens* 34005 (A), July 21, 1933.—Sandakan and vicinity, *D. D. Wood* 810 (A, PBS), 887 (A, PBS), March-June 1920.—Sandakan and vicinity, *M. Ramos* 1549 (A, G, US), Sept.-Dec. 1920.

SARAWAK: Mount Matang, alt. 200 m., *J. & M. S. Clemens* 22321 (A, M).—Mt.

Dulit, moss-forest, alt. ca. 1000 m., *P. W. Richards* 1620 (A), Sept. 8, 1932 (shrub 3 m. high; petals white, the calyx pinkish; leaves thick and leathery).

Small trees with dark brown bark; branchlets terete, glabrous even to the current year's growth, the terminal buds glabrous, only very rarely sparsely pubescent. Leaves coriaceous, elliptic-oblong, 6–10 cm. long, ca. 4 cm. wide, usually obtuse at the apex with an obtuse acumen, tapering at the base into a short petiole, the mature leaves glabrous on both surfaces, very rarely the under surface of the very young leaves lightly pubescent along the midrib, the margin entire or obsoletely serrulate, the veins obscure, the petiole ca. 5 mm. long, glabrous. Flowers axillary, solitary, rarely in twos; pedicel up to 1.5 cm. long, glabrous, accrescent towards the apex; bracteoles 2, persistent, opposite, immediately below the calyx, coriaceous, glabrous, subrotund, unequal, 3–4 mm. long, ca. 3 mm. wide, the margin entire or slightly fimbriate; calyx-lobes 5, imbricate, glabrous, broadly ovate, unequal, 7–8 mm. long, 6–7 mm. wide, thickened at the center, the margin scarious, usually entire, occasionally slightly fimbriate; corolla-lobes 5, connate at the base for 3–5 mm., glabrous, white, obovate, up to 16 mm. long, 6–7 mm. wide, bluntly acuminate at the apex; stamens ca. 40, seriate, 9–12 mm. long, the filaments 5–8 mm. long, adnate to the base of the corolla, accrescent towards the apex, densely pubescent, the anthers ca. 4 mm. long, hirsute, the apicule 0.5–1 mm. long, densely pubescent; ovary glabrous, subconical, ca. 4 mm. long, 5 mm. diam.; occasionally furrowed, tapering at the apex into a glabrous style, 5-celled, multi-ovulate. Fruit globose, glabrous, 5-celled, many-seeded.

*Adinandra dumosa*, described by Jack in 1822, is the original species of the genus and possesses the widest range of distribution of any of the Indo-Malayan species. It holds the same position in the Indo-Malayan distribution that *A. Millettii* holds in the Eastern Asiatic distribution. The center of distribution for the species appears to be the island of Sumatra, the range extending northward into Malaya and down through the East Indian Islands into Java and Borneo.

It is probably the most nearly glabrous species in the genus. Even the terminal buds and current year's growth of the branchlets are glabrous. Species of *Adinandra* are often termed glabrous when close observation shows that the terminal buds and current year's growth of branchlets are quite pubescent. As is usual in species of this family, one will find exceptions to the general rule. Specimens collected on the east coast of Sumatra near Bilah have a tendency toward pubescence. A fine scattered spreading pubescence, not too noticeable but enough to be exceptional, may be found along the midrib on the under surface of the leaves. However, the unfolding buds are still quite glabrous since the dorsal surface of the leaf is exposed while unfolding. In the pubescent bud the obvious pubescence is on the dorsal surface of the leaf, which character is quickly dissipated and entirely lost in maturity.

The leaves vary considerably in size and shape. Generally they are bluntly acuminate. Occasionally one finds leaves tapering into a fine acumen. The stamens are numerous with both the anthers and filaments densely pubescent. In the latter case, the pubescence is so dense that it

is difficult to separate the filaments in dissection. This dense pubescence on the filaments in so glabrous a species is surprising. The style develops considerably in fruit, rivaling, at times, the pedicel in length. The bracteoles, always persistent, are small, rounded and spreading. Occasionally, in the very young flower-buds, the bracteoles are lightly appressed-pubescent.

In this study, I have had opportunity to examine authentic material, perhaps isotypes, of *A. Jackiana*, *A. trichocoryna*, *A. cyrtopoda*, *A. stylosa* and *A. glabra*, and find no suitable characters worthy of specific separation. All these names have been listed above as synonyms of *A. dumosa*.

VERNACULAR NAMES: *Kajoe aling*, *kajoe si mar apiapi*, *kajoe apiapi*, *apiapi*, *daun saribu*.

33. *Adinandra verrucosa* Stapf in Hooker's Icon. Pl. 23: t. 2266. 1893; in Trans. Linn. Soc. Bot. II. 4: 133 (Fl. Mt. Kinabalu). 1894. — Merrill, Enum. Born. Plts. 391. 1921. — Melchior in Nat. Pflanzenfam. ed. 2, 21: 144. 1925.

DISTRIBUTION: British North Borneo.

BRITISH NORTH BORNEO: Mt. Kinabalu: Paka Cave to Lobang, *M. S. Clemens* 10735 (TOPOTYPES, A, PBS), Nov. 15, 1915 (flowers pink). — Upper Kinabalu, alt. 2000–4000 m., *J. & M. S. Clemens* 29113 (A), March 27, 1932 (flowers pale pink suffused with white). — Head Kinatak, along margin of open place, alt. ca. 3000 m., *J. & M. S. Clemens* 33121 (A), Feb. 27, 1933 (small tree 8 m. high; flowers green and pink; fruit purplish green).

Tree ca. 10 m. (fide Clemens) high; branchlets terete, glabrous, sturdy, noticeably thicker than those of most other species, verrucose-lenticellate, the terminal buds glabrous except for very light pubescence at the apex, the margin ciliate, otherwise glabrous. Leaves thick-coriaceous, oblong-elliptic, 12–15 cm. long, 5–6 cm. wide, obtusely emarginate at the apex, somewhat rounded at the base, glabrous on both surfaces, dark-punctate beneath, the midrib conspicuous beneath, bisulcate (in dried specimens), the veins inconspicuous on both surfaces, the margin quite entire with only occasional sharp denticulations, the petiole thick, sturdy, glabrous, usually 7–8 mm. long, sometimes only 4 mm. long. Flowers axillary, solitary or in twos or threes; pedicel sturdy, glabrous, seldom over 5 mm. long, often as thick as long; bracteoles 2, persistent, glabrous, opposite, immediately below the calyx, rounded, 3–4 mm. long and wide; calyx-lobes 5, imbricate, glabrous, rounded, 6–8 mm. long; corolla-lobes 5, glabrous, pale rose or pink suffused with white (Clemens), broadly ovate-elliptic, contracted noticeably at the base, 16–20 mm. long, 10–12 mm. wide; stamens apparently 4- or even 5-seriate, 20–24, apiculate, the filaments joined nearly their entire length, varying in length from the shorter or inner series, 7–8 mm. long, to the longer or outer series, ca. 13 mm. long, densely appressed-sericeous (silvery white) pubescent on the upper half of the dorsal surface, sparsely or occasionally pubescent on the lower half, the anthers oblong, uniformly ca. 5 mm. long, densely sericeous on the dorsal surface; ovary somewhat ovoid, ca. 4–5 mm. diam., glabrous, 5-celled, multi-ovulate, tapering rather abruptly into a thickened glabrous style, ca. 1.5 cm. long. Fruit globose, glabrous, ca. 1 cm. or more diam. Seeds many, minute, shining subreniform.

From the specimens examined and from the literature concerning *A.*



*verrucosa*, it appears that this species is confined to the "Upper Mountain-Zone" of Mt. Kinabalu, North Borneo. According to Stapf the altitude range of this zone is "6000-10000" feet.

Except for the pubescence on the stamens, this species is entirely glabrous. The sturdy character of all parts of the plant is the first feature which impresses one. However, the verrucose-lenticellate character of the young branchlets, the very short and thick pedicels, the bisulcate midrib (lower leaf surface) and the thick leaves and petioles are other features which tend to distinguish the species from most of the other near relatives.

34. *Adinandra colombonensis*, sp. nov.

Arbor ?; ramis griseis vel griseo-brunneis, glabris, teretibus, ramulis brunneis, glabris, teretibus, innovationibus adpresso-pubescentibus. Folia subcoriacea vel chartacea, elliptica, 6-10 cm. longa, 3-4 cm. lata, apice gradatim attenuata vel rare abrupte acuminata, basi gradatim cuneata, supra glabra, subtus glabra vel leviter adpresso-pubescentia, margine integra vel undulata, venis supra obscuris, subtus primariis 8-10 paribus juxta marginem arcuantibus, venis secundariis inter primarias frequentibus, petiolis 2-3 mm. longis, glabris vel leviter pubescentibus. Flores axillares, solitarii; pedicellis teretibus, 2 cm. longis, adpresso-pubescentibus; bracteo-  
lis 2, oppositis, persistentibus, leviter adpresso-pubescentibus, subdeltoideis, circiter 1.5 mm. longis; sepalis 5, imbricatis, adpresso-pubescentibus, margine ciliolatis, exterioribus duobus late ovatis circiter 5 mm. longis, 6 mm. latis, interioribus tribus ovatis, 5-7 mm. longis, 4-5 mm. latis, margine scariosis; petalis 5, albidis, glabris, basi 5 mm. connatis, circiter 15 mm. longis, 5-6 mm. latis, apice subrotundatis; staminibus circiter 40, 8-13 mm. longis, 4-seriatis, filamentis hirsutis, liberis, basi ad corollam adnatis, 5-9 mm. longis, antheris brunneis, elongatis, 3-5 mm. longis, hirsutis, ovario glabro, subgloboso, 5-sulcato, 5-loculari, multi-ovulato, stylo glabro, circiter 12 mm. longo. Fructus non visi.

DISTRIBUTION: British North Borneo.

BRITISH NORTH BORNEO: Mt. Kinabalu, Colombon basin, alt. 1500 m., *J. & M. S. Clemens* 34237 (TYPE, A), Aug. 2, 1933 (flowers white with brown anthers).—Mt. Kinabalu, Colombon River, alt. 2000 m., *J. & M. S. Clemens* 33770 (A), June 28, 1933 (flower-buds cream-colored).

This species is closely related to *A. caudatifolia* Kob., but is separated by the 5-celled ovary and many ovules. It is safe to assume that in fruit *A. colombonensis* will produce many seeds. This assumption can be drawn from the size and number of ovules in the ovary.

35. *Adinandra excelsa* Korthals, Verh. Nat. Gesch. Bot. ed. Temminck, 109. 1840. — Miquel, Fl. Ned. Ind. 1 (2): 477. 1859; Ann. Mus. Bot. Lugd.-Bat. 4: 103. 1868. — Szyszylowicz in Nat. Pflanzenfam. III. 6: 189. 1893. — Stapf in Trans. Linn. Soc. London 4: 133 (Fl. Mt. Kinabalu). 1894. — Merrill, Enum. Born. Plts. 391. 1921. — Melchior in Nat. Pflanzenfam. ed. 2, 21: 144. 1925.

DISTRIBUTION: Borneo, British North Borneo.

BORNEO: Exact locality lacking, *P. W. Korthals s. n.* (probable ISOTYPE, G, NY).  
BRITISH NORTH BORNEO: Mt. Kalawat, trail, *M. S. Clemens* 11168 (P.B.S.), Dec. 10-11, 1915 (small tree with white flowers and green fruit).

Tree ca. 10 m. high; branches and branchlets brownish, terete, glabrous, the terminal buds elongate-conical, densely sericeous-pubescent. Leaves

coriaceous, oblong-ovate, 9–15 cm. long, 4–6.5 cm. wide, somewhat acute or shortly oblong-acuminate at the apex, rounded or obtuse at the base, glabrous on both surfaces, punctate-dotted beneath, obsoletely serrulate at the margin, the veins (up to 12 pairs) conspicuous on both surfaces, arching upward near the margin, the petiole semi-terete, flat above, glabrous, 0.5–1 cm. long. Flowers axillary, solitary; pedicels thin, 2–3 cm. long, glabrous, swelling noticeably above the longer bracteole into the calyx; bracteoles 2, persistent, alternate below the calyx, unequal, deltoid to subrotund, minute, 1.5–2 mm. long, glabrous; calyx-lobes 5, imbricate, coriaceous, subequal, subrotund, ca. 7 mm. long and wide, glabrous; corolla-lobes 5, connate at the base, oblong, obtuse at the apex, fleshy, glabrous, ca. 12 mm. long, 6 mm. wide, white; stamens many, several-seriate, the filaments linear, glabrous, joined at the base, the anthers oblong, densely hirsute; ovary glabrous, somewhat conical, 5-celled, multi-ovulate, tapering at the apex into a glabrous style. Fruit globose, glabrous, 5-celled, many-seeded, attenuate at the apex into a persistent style.

According to Stapf, this species may be found in Sumatra. Only material from Borneo was available for study and this material contained little more than four probable isotypes.

*Adinandra excelsa* appears very closely allied to the type-species *A. dumosa*, but can be distinguished by the sericeous buds, the alternate bracteoles, glabrous and subdeltoid, and the glabrous filaments.

Distinguishing characters are: (1) the glabrous ovary and fruit; (2) leaves glabrous on both surfaces but sericeous in bud; (3) glabrous calyx-lobes and corolla-lobes; (4) glabrous, deltoid, alternate persistent bracteoles; and (5) glabrous filaments.

Koorders describes the ovary as single-celled. However, dissections have shown it to be distinctly five-celled and multi-ovulate. The fruit is clearly five-celled also.

### 36. *Adinandra polyneura*, sp. nov.

Arbor ?; ramis teretibus, glabris, griseo-brunneis; ramulis teretibus, glabris, rubro-brunneis; gemmis terminalibus elongatis, luteo-adpresso-pubescentibus. Folia coriacea, oblongo-elliptica vel oblongo-obovata, apice gracili-acuminata, basi attenuata, supra glabra, subtus glabra vel glabrescentia, rariter leviter adpresso-pubescentia, fusco-punctata, margine subintegra vel crenulata, venis lateralibus primariis 20+ paribus, ad marginem non arcuantibus sed reticulatis, petiolis glabris, ut videtur circiter 1 cm. longis. Flores axillares, solitarii; pedicellis glabris, 1–1.5 cm. longis subcostatis; bracteolis 2, persistentibus, suboppositis, subdeltoideis vel late ovatis, glabris, circiter 3 mm. longis, 4 mm. latis, costatis; sepalis 5, imbricatis, glabris, subaequalibus, subrotundatis vel late ovatis, 8–9 mm. longis et latis, margine ciliolatis vel glandulosis; petalis 5, basi connatis, oblongo-obovatis, 17–20 mm. longis, 9–10 mm. latis, apice rotundatis, exteriore adpresso-pubescentibus, margine scariosis; staminibus 30–35, 3-seriatis, 10–14 mm. longis, filamentis 5–8 mm. longis, basi connatis, ad corollam adnatis, dense hirsutis, antheris elongatis, 5–6 mm. longis, dense hirsutis; ovario subglobozo, glabro, 5–6 mm. diametro, 5-loculari, multi-ovulato, stylo glabro, circiter 13 mm. longo, basi circiter 3 mm. diametro.

DISTRIBUTION: Netherlands East Indies (Sumatra).

SUMATRA: West Coast, Pajacombo Oeloe Air, alt. ca. 1100 m., *Netherlands For. Expt. Station b.b. 5173* (TYPE, K, fragment, A), July 7, 1922.

The leaves of this new species resemble very much those of *A. myrioneura* Kob., and *A. borneensis* Kob. both of Borneo, in the large number of veins. In *A. myrioneura*, however, the corolla is glabrous, the bracteoles caducous, and the calyx, ovary and style pubescent. In *A. polyneura* the corolla is pubescent, the bracteoles persistent, and the calyx, ovary and style glabrous. In *A. borneensis* the bracteoles are caducous and the calyx is pubescent.

The petioles of the leaves of *A. polyneura* appear to be rather outstanding in that they seem to measure over a centimeter in length. This apparent length is caused by the gradual tapering of the blade along the petiole in a slight wing-formation. The actual petiole hardly exceeds in length that of the majority of species in this genus.

Another interesting feature is the slight keel on the dorsal surface of the bracteole. Also, the pedicel appears 2-ridged, caused by the decurrence of the bracteole to the base, very much as a stem with decurrent leaves.

VERNACULAR NAME: *Madang limbe*.

37. *Adinandra angulata* Ridley in Jour. Linn. Soc. Bot. 38: 304. 1908; Fl. Malay Penin. 1: 195. 1922.—Melchior in Nat. Pflanzenfam. ed. 2, 21: 144. 1925.

DISTRIBUTION: Malay Peninsula (Pahang).

MALAY PENINSULA: Pahang: Gunong Tahan, alt. 1700–1800 m., *L. Wray & H. C. Robinson 5518* (TYPE, K), July 12, 1905 (tree 12–16 m. high).

Tree 12–18 m. high; branches rough, sturdy, grayish brown, glabrous, 4-angled, lightly winged, the young branchlets conspicuously winged, glabrous, thick, as much as 5 mm. in diameter, the terminal buds sericeous. Leaves thick-coriaceous, elliptic, 10–15 cm. long, 5–7 cm. wide, obtusely acuminate to subrotund at the apex, acute at the base, glandular-apiculate along the margin from the base to the apex, less conspicuously so near the base, glabrous on both surfaces, the veins conspicuous on both surfaces even to the fine reticulations, 8–9 pairs arcuate-ascending near the margin, interspersed with an equal number of secondary veins, nearly as conspicuous but not as long, the petiole thick, glabrous, ca. 1 cm. long, ca. 4 mm. in diameter. Flowers in pairs, presumably axillary (none attached); pedicels in pairs, sturdy, up to 5 cm. long, glabrous, flattened, ca. 1 mm. in diameter at the base, accrescent to 5 mm. in diameter at the apex, the narrow edges terminating in the bracteoles; bracteoles 2, small, almost vestigial, persistent, unequal, subdeltoid, subopposite, the lower bracteole 1+ mm. long, the upper bracteole 2+ mm. long; calyx-lobes 5, imbricate, rounded, glabrous, ca. 7 mm. long, 8 mm. wide; corolla-lobes (bud) 5, glabrous, ca. 12 mm. long, 6 mm. wide, thick, almost woody in texture; stamens (bud) ca. 35, seemingly 4-seriate, 6–7 mm. long, the filaments joined at the base, glabrous, the longer filaments equalling the anthers in length, the anthers hirsute; ovary glabrous, hemispherical, tapering at the apex into a glabrous style, 3-celled, two cells normal, one cell compressed, ovules few. Fruit globose, glabrous, ca. 1.5 cm. in diameter, 3-celled, few-seeded, 1–2 seeds per cell. Seeds few, large, 8–9 mm. long, 6–7 mm. across, flattened, dark, lustrous.

The branches and branchlets in this species are angled and winged. This character, along with the thick, conspicuously veined leaves, the long



thick pedicels (5 cm. long) in pairs, and the large seeds makes this species one of the most outstanding in the genus.

Ridley, in his original description, referred to the flowers as "Flores non visi." However, buds were available for dissection. Considering the size of the seeds, so few in number, and the irregularity in the cells of the fruit, I felt compelled to dissect one of the few buds accompanying the type to prove to myself that this species belonged to the genus *Adinandra*.

In the fruit, I found three cells, two of which were larger than the third and occupied most of the fruit. The third cell was compressed along the wall of the fruit and was seedless. The two large cells contained only three seeds between them. These seeds were three times the size normally found in the genus, very uniformly scrobiculate and typical of *Adinandra*. In the ovary of the flower-bud, the same condition existed, namely two large cells and one smaller cell. The ovules, few in number, in the bud-stage were as large or larger than the mature seeds in most other species of the genus.

Otherwise, characters in the flower-bud appeared to be typical for the genus. The stamens numbered about 35, possessed hirsute anthers which were quite uniform in size and equalled the longest filaments in length. The corolla-lobes seemed thick in texture.

On paper, this species is difficult to separate from *A. Sarosanthera*. In most instances, *A. Sarosanthera* has terete branchlets. However, in rare cases in the species, one finds definitely angled branchlets, but not as pronounced as in *A. angulata* where it appears to be the dominant character, extending to the branches themselves.

Both species have 3-celled ovaries, not so well defined in *A. angulata*, and both have few but large seeds developing in the fruit. In both species the pedicels are elongated, somewhat flattened, and the bracteoles are quite minute. In *A. angulata* the veins are very prominent on both surfaces with almost equally pronounced reticulations. The bracteoles are quite deltoid and occasionally apiculate. In *A. Sarosanthera* the veins are obscure on the upper surface, only lightly conspicuous beneath, and the bracteoles are rounded.

A second related species is *A. laotica* Gagnepain from Laos, Indo-China. In the latter species the ovary and fruit are 5-celled and the bracteoles are caducous.

38. *Adinandra Sarosanthera* Miquel, Fl. Ned. Ind. 1 (2): 477. 1859; Ann. Mus. Bot. Lugd.-Bat. 4: 104. 1868. — Szyszylowicz in Nat. Pflanzenfam. III. 6: 189. 1893. — Merrill, Enum. Born. Plts. 391. 1921; in Univ. Calif. Publ. Bot. 15: 198. 1929, as "*sarcosanthera*." — Melchior in Nat. Pflanzenfam. ed. 2, 21: 144. 1925.
- Sarosanthra excelsa* Korthals, Verh. Nat. Gesch. Bot. ed. Temminck 104. 1840.
- Adinandra lampanga* Miquel, Fl. Ned. Ind. Suppl. 1: 479. 1862; Ann. Mus. Bot. Lugd.-Bat. 4: 104. 1868. — Szyszylowicz in Nat. Pflanzenfam. III. 6: 189. 1893, as "*lampango*." — Koorders & Valetton, Meded. 'S Lands. Pl. 16: 220 (Bijdr. Boomsoort. Java 3: 220). 1896. — Melchior in Nat. Pflanzenfam. ed. 2, 21: 144. 1925.
- Adinandra macrantha* Teijsmann & Binnendijk in Tijdschr. Ned. Ind. 25: 421. 1863. — King in Jour. As. Soc. Bengal 52 (2): 191 (Mater. Fl. Malay Penin. 1: 131). 1890. — Szyszylowicz in Nat. Pflanzenfam. III. 6: 189. 1893. — Ridley, Fl. Malay Penin. 1: 195. 1922.

*Adinandra leiopetala* Miquel, Ann. Mus. Bot. Lugd.-Bat. 4: 104. 1868. — Melchior in Nat. Pflanzenfam. ed. 2, 21: 144. 1925.

DISTRIBUTION: British North Borneo, Netherlands East Indies (Borneo, Java, Sumatra), Malay Peninsula (Johore, Perak, Pahang).

BRITISH NORTH BORNEO: Elphinstone Prov., Tawao, *A. D. E. Elmer* 21629 (A, C, M), 21727 (C, G, M, NY), Oct. 1922–March 1923.

BORNEO: Exact locality lacking, *P. W. Korthals* s. n. (probable ISOTYPE, G). JAVA: Cult. Bot. Gard. Buitenzorg, no. VI. c. 6. (G, NY, US), 1903. SUMATRA: Atjeh en Ond. Gajo Loeës, Penosan (Gn. Bohgane & Rangoet Galang), alt. ca. 1800–1900 m., *Neth. Ind. For. Serv. b.b.* 22381, 22391, 22400 (A) Feb. 1–3, 1937. — East Coast, vicinity of Aek Moente (Aer Moette), Asahan (northeast of Tomoean Dolok and west of Salabat), alt. ca. 500 m., *Rahmat Si Boeea* 9132 (A), Jan.–July 1936. — Palembang, Banjoesin en Koeboestreken, *A. Thorenaar* 111 (A), July 14, 1911. — Palembang, Lementang Ilir, Semangoes, *Neth. Ind. For. Serv. b.b.* 32125 (A), June 27, 1940. — Lampong, *J. E. Teysmann* s. n. (G). — Exact locality lacking, *H. O. Forbes* 3191 (G).

MALAY PENINSULA: Perak: Sungei Krian Estate, at sea level, *G. H. Spare* 36003 (A). Johore: Bagan Liman, Sedili River, at low alt., *E. J. H. Corner* 23896 (NY), Feb. 18, 1931. — Sungai Sedili, *E. J. H. Corner* 25992 (NY), Aug. 28, 1932 (large tree 17 m. high). — Kangka Sedili Kechil, at low alt., *E. J. H. Corner* 28581 (A, NY), June 18, 1934. — Sungai Kayu, Mawai-Jemuluang Rd., in swampy forest, at low alt., *E. J. H. Corner* 28728 (A), Feb. 5, 1935. Pahang: Sungai Bera, near Tasek Bera, at low alt., *M. R. Henderson* 24113 (NY).

Tree 25–30 m. high; branchlets brown, glabrous, appressed-pubescent when very young, the buds densely sericeous. Leaves coriaceous, oblong-elliptic, 9–12 cm. long, 4–5 cm. wide (often much larger, 15–18 cm. long, 6.5–7 cm. wide), obtusely acuminate at the apex, narrowed at the base, the lower portion of the margin entire, the upper part finely serrulate, glabrous when mature (thinly appressed-pubescent beneath when immature), the midrib conspicuous, the primary veins numerous, evenly spaced, conspicuous on both surfaces, the petiole short, 5 mm. or less, somewhat winged on the upper surface, lower surface semi-terete. Flowers axillary, usually solitary, occasionally in twos; pedicel long, 3–4.5 cm., glabrous, quite erect, often nodding at the apex, the bracteoles 2, minute, quite rounded, opposite or slightly alternate below the calyx; calyx-lobes 5, somewhat coriaceous, imbricate, glabrous, varying from 5 × 6 mm. (outer lobes) to 8 × 12 mm. (inner lobes), the outer lobes weakly glandular-denticulate along the margin, the inner lobes with a membranous margin but no denticulations; corolla-lobes 5, obovate, 1.5–1.7 cm. long, glabrous or thinly pubescent on the external surface near the apex; stamens 30–50, up to 4-seriate, adnate to the base of the corolla, the filaments unequal in length, united, glabrous or nearly so, short (1–3 mm.), the anthers oblong, brownish, pubescent; ovary variable in pubescence, sometimes quite glabrous, pubescent at the apex, just below the style, or pubescent throughout, tapering at the apex into the style, 3-celled, several-ovuled. Fruit globose, up to 2 cm. in diameter, glabrous or glabrescent, with a few straggling hairs at the apex, 3-celled, seldom over 6 seeds in a single locule, sometimes only 6 in the entire fruit. Seeds flat, hippocrepiform, up to 8 mm. long.

This species was originally described by Korthals (1840) under the genus *Sarosanthra* as *S. excelsa*. Later, Miquel rightfully transferred the genus to *Adinandra*. Since the species *A. excelsa* Korthals already existed Miquel selected the name *A. Sarosanthra* as most suitable.

The distinguishing characters of this species are: (1) 3-celled pubescent ovary (usually completely pubescent, occasionally pubescent near the apex only and rarely completely glabrous); (2) large globose fruit (up to 2 cm. diam.), glabrescent, 3-celled or incompletely so, with large seeds up to 8 mm. in diameter (2 or 3 to a cell); (3) filaments glabrous or nearly so with occasional appressed hairs on the exterior surface; (4) styles glabrous; (5) calyx-lobes glabrous; (6) corolla-lobes glabrous; (7) primary veins many (ca. 20 pairs) evenly spaced and quite scalariform in appearance; and (8) pedicel 3–4.5 cm. long.

This species is nearly as widespread as *A. dumosa* Jack, extending from Borneo through Sumatra and some of the smaller East Indian islands up into the Malayan Peninsula.

In Borneo it has been referred to as *A. Sarosanthera* (and rightly so) by students of that island flora. In Sumatra, workers have called it *A. lamponga* and on the Malayan Peninsula it has been known as *A. macrantha*. The last two names have been combined before. Koorders and Valetton (1896) suggested the very close relationship among the three and felt that they should be combined under a single species.

In a species as widespread as this, and especially in this family, one must expect considerable variation. The ovary, in authentic material from Sumatra, is extremely variable. Material collected by *J. E. Teysmann s. n.* from Lampong in southern Sumatra, the type-locality of *A. lamponga*, presents a pubescent ovary. *Rahmat Si Boeea 9132* collected on the east coast of Sumatra near Asahan also has a pubescent ovary. *Thorenaar 111* and *Neth. Ind. For. Serv. b.b. 32125* collected near Palembang, Sumatra, both in fruit, show the ovary to have been pubescent because, although glabrescent in maturity, there are vestiges of pubescence at the apex. *Forbes 3191* collected in Sumatra (the locality unknown to me), has a glabrous ovary. Cultivated in the Botanical Garden at Buitenzorg, Java, under the number (VI-c-6), is a specimen with a distinctly glabrous ovary. From British North Borneo *Elmer 21629* in mature fruit seems to be quite glabrous and one may assume that the ovary was glabrous or nearly so in the flowering stage. A Korthals specimen from Borneo labeled *A. Sarosanthera* has flowers with the ovary distinctly glabrous.

Apropos of this discussion of pubescence, Koorders & Valetton in their discussion of *A. lamponga* (see reference above), stated that their description was drawn up according to specimens in the herbarium of Koorders. They stated further that the living authentic specimen of *A. macrantha* [Hort. Bog. VI-c-6] examined by them was identical with *A. lamponga* and they united the two species under *A. lamponga* after comparison of *A. macrantha* with an authentic specimen [*A. lamponga*] in "Herb. Bogor." and with the description by Miquel with which it appeared to them to agree fully. Only in the Sumatran specimen was the ovary truly pubescent. In Koorders' specimen the ovary was pubescent only at the apex. Koorders & Valetton stated that some specimens from Djampang-Koelön (*Herb. Kds. 8159β*) differed through an entirely glabrous ovary and much



larger fruit 2.5 cm.  $\times$  2 cm. with the fruit walls 4 mm. thick. As for the leaves, the description of *A. leiopetala* Miquel agreed better with their specimen than that of *A. lamponga*. In the specimen of Teysmann in Herb. Hort. Bog., however, the leaves agree with the description of *A. leiopetala* in the projecting base. Koorders & Valeton also feel that both species are very nearly related to *A. Sarosanthera* Miq.

I have vacillated considerably in my attitude concerning this species, going so far as to attempt to write them up separately. However, my final conclusion is that the whole group should be combined under a single species, *A. Sarosanthera* Miq., even though the variation, especially in the pubescence of the ovary, is considerable.

In a few of the specimens, particularly those collected by E. J. H. Corner in Johore, the young branchlets are quite noticeably angled. From the size of the leaves and branchlets, especially *Corner 28581*, I feel further that the specimens must have been collected from very vigorous young shoots.

39. *Adinandra cordifolia* Ridley in Kew Bull. Misc. Inform. 1938: 173. 1938.

DISTRIBUTION: Sarawak, British North Borneo.

SARAWAK: Kuching, *G. D. Haviland* (= *b. p. r. c.*) *K. S.* = 23 (ISOTYPE, G), Sept. 19, 1892. BRITISH NORTH BORNEO: Mt. Kinabalu: Tenompak, alt. 1650 m., *J. & M. S. Clemens 29929* (A), June 8–11, 1932 (flower-buds opening white, the flowers with pure white petals and brown stamens).—Marai Parai, Upper Kinataki Gorge, alt. 1800 m., *J. & M. S. Clemens 32434* (A), March 29, 1933 (tree 20 m. high; flowers cream-colored).—Marai Parai, head of the Sadikan River, alt. 2000 m., *J. & M. S. Clemens 32863* (A), April 22, 1933 (tree 7 m. high; buds gray).

Tree up to 20 m. high; branchlets terete, brown, glabrous, the very young branchlets appressed-pubescent, the terminal buds conical, appressed-pubescent. Leaves coriaceous, oblong-elliptic, 11–20 cm. long, 5–8 cm. wide, acuminate or obtusely acuminate at the apex, unequally cordate at the base, glabrous (the lower surface of the very young leaves pubescent), the margin recurved, entire or nearly so, the veins 10–12 pairs, conspicuous on the lower surface, the petiole thick, very brief, 2–3 mm. long, occasionally subsessile. Flowers axillary, solitary or in pairs; pedicel thick, sericeous, ca. 5 mm. long; bracteoles 2, persistent, coriaceous, opposite, immediately below the calyx, sericeous, unequal, the smaller one ca. 3 mm. long, 4 mm. wide, rounded, the larger one ca. 6 mm. long, 8 mm. wide; calyx-lobes 5, imbricate, sericeous, unequal, broader than long, the outer lobes larger, ca. 12 mm. long, 18 mm. wide, ca. 2 mm. thick at the base, the inner lobes ca. 8 mm. long, 9 mm. wide, the margin scarious; corolla-lobes 5, connate at the base, oblong, glabrous, ca. 20 mm. long, 10 mm. wide, rounded at the apex; stamens ca. 40, 2- or 3-seriate, 11–17 mm. long (in a single flower), the filaments 7–11 mm. long, connate at the base, adnate to the base of the corolla, lightly pubescent, at least on the upper half, the anthers oblong, ca. 5 mm. long, merely lightly pubescent, some appearing glabrous; ovary sericeous, subglobose, ca. 4 mm. diam., 5-celled, multi-ovulate, the style ca. 13 mm. long, sericeous at the base, otherwise glabrous. Fruit not seen.

The large cordate leaves and the very large flowers are the outstanding characters in this species. The Clemens material cited above made

possible very essential additions to Ridley's original description. The ovary is 5-celled and multi-ovulate; the style 13 mm. long and glabrous except at the base; the stamens are unusually long with the anthers only slightly and intermittently lightly pubescent; the corolla-lobes are glabrous and up to 20 mm. long; the calyx-lobes are broader than long, sericeous, the outer larger than the inner. Ordinarily, the inner lobes are the larger.

39a. *Adinandra cordifolia* var. *strigosa*, var. nov.

Arbor; ramis teretibus, brunneis dense adpresso-pubescentibus, ramulis juventute dense flavo-sericeis, gemmis terminalibus, conicis, dense flavo-sericeis. Folia crasso-coriacea, elliptico-oblonga vel elliptica, 18–21 cm. longa, 11–12 cm. lata, apice abrupte acuminata, basi inaequilateralis, subcordata, supra nitida, glabra, subtus dense pallido-pubescentia, margine ut videtur integra, venis primariis 18–20 paribus, subtus conspicuissimis, intra marginem anastomosantibus, venis secundariis inter primarias frequentibus, petiolis minutis, ca. 1–2 mm. longis, dense pubescentibus, vel rariter subsessilibus. Flores non visi. Fructus juvenes axillares, solitarii; pedicellis ca. 1 cm. longis, teretibus, dense fulvo-pubescentibus, recurvatis; bracteis 2, oppositis, persistentibus, pubescentibus, subrotundatis, inaequalibus, circiter  $3 \times 4$  mm. et  $5 \times 6$  mm.; sepalis 5, imbricatis, subrotundatis, dense adpresso-fulvo-pubescentibus, inaequalibus, circiter 8–10 mm. longis, 7–11 mm. latis; ovario elongato-globoso, sericeo, 5-sulcato, 5-loculari, multi-ovulato; stylo circiter 1 cm. longo, glabro basi excepto.

DISTRIBUTION: British North Borneo.

BRITISH NORTH BORNEO: Mt. Kinabalu: Dallas, alt. 1000 m., *J. & M. S. Clemens* 26229 (TYPE, A), Aug. 21, 1931. — Upper Mt. Kinabalu, Penibukan, west ridge, jungle, alt. 1350 m., *J. & M. S. Clemens* 40774 (A), Oct. 18, 1933 (tree).

The main difference between *A. cordifolia* and its variety *A. cordifolia* var. *strigosa* lies in the permanence of the pubescence. Both entities are pubescent in the terminal bud, the very young unfolding leaves, and the young branchlets. In the species this pubescence appears to be very evanescent, the leaves and older branchlets shortly becoming quite glabrous or glabrescent. In the variety, the disappearance of the pubescence is less rapid. In branchlets showing growth of over a single year and in the mature leaves a dense strigose pubescence, perhaps permanent, is found.

Because of this very apparent difference one is inclined at first to consider the two as separate species. However, when an accurate appraisal of all parts has been made, the persistence of this pubescence seems to be the single basis of separation.

In the type, *J. & M. S. Clemens* 26229, the young fruits are subtended by calyces similar in size to those of the species. However, in *J. & M. S. Clemens* 40774, the second specimen cited, the calyx-lobes are somewhat smaller, measuring ca. 8 mm. in length.

40. *Adinandra subsessilis* Airy-Shaw in Kew Bull. Misc. Inform. 1939: 505. 1939.

DISTRIBUTION: Sarawak.

SARAWAK: Mt. Dulit, on steep slope of rain-forest, alt. 700–900 m., *Native Collector* (P. W. Richards no. 1958) (A, ISOTYPE), Sept. 19, 1932 (small tree with "whitish" petals).

Small tree; branchlets terete, brownish, later glabrescent, the very young branchlets pilose, the buds sericeous. Leaves chartaceous or subcoriaceous, elliptic-oblong to oblong-ovate, 5–11 cm. long, 1.5–3.5 cm. wide, distinctly acuminate at the apex with the acumen nearly 2 cm. long, narrowed at the base, occasionally subrotund, the margin subentire, minutely glandular-serrulate, glabrous on the upper surface, appressed-pubescent beneath, later glabrescent, the midrib lightly impressed above, prominent beneath, pubescent, the veins 12–14 pairs prominent on both surfaces, arching upward and anastomosing, the petiole 2 mm. long, pubescent. Flowers axillary, solitary; pedicel very short, 1–2 mm. long, densely sericeous; bracteoles 2, persistent, sepaloïd, ovate, opposite, immediately below the calyx, about as long as the pedicel, densely sericeous; calyx-lobes 5, imbricate, unequal, thickened, deltoid-ovate, acute, sericeous on the exterior surface, glabrous within, the two outer lobes 3–5 mm. long, 2–3 mm. wide, 3 inner lobes larger, 4–7 mm. long, 3–3.5 mm. wide; corolla-lobes 5, white, broadly obovate, 8–9 mm. long, 7–8 mm. wide, rounded at the apex, sericeous along the median portion of the exterior surface, otherwise glabrous; stamens (fide Airy-Shaw) about 30, uni-seriate, 4–6 mm. long, joined at the base and adnate to the base of the corolla, the filaments hairy along the upper portion, the lower part glabrous, the anthers lanceolate, 2–3 mm. long, sericeous on lower portion of dorsal surface, otherwise glabrous; ovary depressed-globose, 2.5 cm. diam., densely sericeous, 2-celled, pauci-ovulate, the style 5–6 mm. long, glabrous or slightly pubescent at the base. Fruit (Airy-Shaw) subglobose, ca. 8 mm. diam., long-pilose, 2-celled, each cell one-seeded. Seeds discoid, 6–7 mm. diam., 1–2 mm. thick, shining.

According to Airy-Shaw's findings, the developed fruit of this species is two-celled with a single large seed in each cell. I have not had an opportunity to observe this unusual feature but have examined an ovary from a bud of an isotype. A dissection showed the two cells in the ovary with a small number (approximately four) of ovules in each cell. This was the first species described with a two-celled ovary and fruit. The seeds are 6–7 mm. long, adding another species to the small group in which the seeds are few in number and develop to a size at least twice that which is found in the majority of species in this genus. In this paper a second species with a two-celled ovary, *A. nunkokensis*, is presented. This latter species has been collected on Mt. Nunkok, Mt. Kinabalu, in British North Borneo. The only evidence of relationship between these two entities appears to be the two-celled ovary.

Besides the ovary, the features which are helpful in identification are: (1) nearly sessile leaves with the petiole not more than 2 mm. long, and the apex long-acuminate; (2) pedicels very brief (1–2 mm. long), or the flowers subsessile; and (3) ovary and fruit long-pilose, the style glabrous except at the base.

41. *Adinandra parvifolia* Ridley in Jour. As. Soc. Straits Settl. 54: 23. 1910; Fl. Malay Penin. 1: 195. 1922. — Melchior in Nat. Pflanzenfam. ed. 2, 21: 144. 1925.

*Adinandra montana* Ridley in Jour. Fed. Malay States Mus. 6: 44. 1915. — Non Merrill.

DISTRIBUTION: Malay Peninsula (Pahang, Perak).



PAHANG: Gunong Tahan, alt. 1650–1800 m., *L. Wray & H. C. Robinson 5517* (K), July 12, 1905 (tree 10–15 m. high with white flowers). PERAK: Gunong Kerbau, alt. 2200 m., *H. C. Robinson s. n.* (TYPE of *A. montana*, K), March 14, 1913.

Tree 10–15 m. high; branches grayish brown, terete, glabrous, the branchlets brown, glabrous, the terminal buds sericeous. Leaves coriaceous, glabrous, elliptic, 6–8 cm. long, 3–4 cm. wide, obtuse at the apex, acute at the base, the margin somewhat recurved, lightly glandular-serrulate, the veins ca. 6–8 pairs, usually rather inconspicuous, occasionally conspicuous, dark glandular-dotted on the lower surface, the petiole 5–7 mm. long. Flowers axillary, solitary, large, ca. 2 cm. in diameter; pedicel ca. 1 cm. long, glabrous; bracteoles 2, persistent, opposite, immediately below the calyx, glabrous, broadly ovate, unequal, ca.  $2 \times 2$  mm. and  $3 \times 3$  mm.; calyx-lobes 5, imbricate, ca. 1 cm. long and wide, unequal, the outer lobes broadly ovate, finely pubescent over all the external surface, the inner lobes more nearly rounded, pubescent on the central portion of the external surface only, the margin scarious, glabrous; corolla-lobes 5, lightly connate at the very base, obovate, 15–16 mm. long, 9–12 mm. wide, pubescent on the upper half of the median portion of the external surface; stamens 40–45, ?-seriate, unequal 8–12 mm. long, the filaments variable in length 3–6.5 mm. long, pubescent on the upper third, joined at the base, adnate to the base of the corolla, the anthers oblong, ca. 5 mm. long, hirsute; ovary ca. 5 mm. across, densely pubescent, longitudinally furrowed, 5-celled, multi-ovulate, tapering at the apex into a style ca. 1 cm. long. Fruit not seen.

The outstanding characters of this species to be used in determination are: (1) small oblong-elliptic leaves up to 8 cm. long, lightly veined with 6–8 pairs of veins; (2) glabrous pedicels (ca. 1 cm. long) and bracteoles, the latter persistent, unequal, and broadly ovate; (3) broadly spreading flowers, up to 2 cm. in diameter with long (15–16 mm.) pubescent corolla-lobes; (4) stamens long (up to 12 mm.), the anthers hirsute, ca. 5 mm. long, the filaments up to 6.5 mm. long and pubescent along the upper third, otherwise glabrous; and (5) ovary pubescent, longitudinally furrowed, 5-celled.

Ridley himself listed *A. montana* Ridley as a synonym of this species. *Adinandra montana* Ridley (1915) should not be confused with the earlier *A. montana* Merrill (1910) from the Philippine Islands. The latter species has been transferred to *Cleyera japonica* Thunberg emend. Sieb. & Zucc. var. *montana* (Merrill) Kobuski.

42. *Adinandra Hullettii* King in Jour. As. Soc. Bengal 59 (2): 191 (Mater. Fl. Malay Penin. 1: 131). 1890. — Szyszyłowicz in Nat. Pflanzenfam. III. 6: 189. 1893. — Ridley, Fl. Malay Penin. 1: 196. 1922. — Melchior in Nat. Pflanzenfam. ed. 2, 21: 144. 1925.

DISTRIBUTION: Malay Peninsula (Singapore).

SINGAPORE: Entrance to Botanic Garden, *R. W. Hullett 103* (TYPE, K), July 1885.

Tree: branches terete, pubescent, furrowed, light brown, the young branchlets densely and minutely rusty-tomentose, the terminal buds densely tawny-sericeous. Leaves coriaceous, oblong-elliptic, 9–14 cm. long, 4–5.5 cm. wide, shortly and bluntly acuminate at the apex, acute at the base, the

margin denticulate, slightly recurved when dry, the upper surface smooth, shining, glabrous, the lower surface opaque, densely and minutely tomentose, the midrib prominent, the nerves spreading, obscure, ca. 10 pairs, the petiole ca. 5 mm. long. Flowers axillary, solitary or in twos; pedicel tomentose, ca. 1 cm. long; bracteoles 2, opposite, persistent, close to the calyx, broadly ovate or deltoid, ca.  $5 \times 5$  mm. and  $3 \times 3$  mm., densely pubescent; calyx-lobes 5, imbricate, fleshy, spreading, broadly ovate, unequal, the two outer lobes joined at the base appearing as though coalesced, ca. 10 mm. long, 8–9 mm. wide, pubescent over the entire exterior surface, the three inner lobes broader than long, ca. 8 mm. long, 9 mm. wide, pubescent on the central portion of the exterior surface, the margin deeply scarious; corolla-lobes 5, ca. 12 mm. long, 5 mm. wide, connate for ca. 5 mm. from the base, rounded and recurved at the apex, glabrous; stamens ca. 45, seemingly 3-seriate, the outer stamens erect, the second and third rows somewhat geniculate with the third or innermost row more geniculate, quite equal in length, the filaments ca. 4 mm. long, geniculate near the anthers, the outer row glabrous, the inner rows occasionally pubescent at the point of geniculation, otherwise glabrous, the anthers oblong, ca. 5 mm. long, densely hirsute, tapering into long, quite blunt apicules, the apicules glabrous; ovary conical-hemispherical appressed-sericeous, ca. 4 mm. diameter, 5-celled, multi-ovulate, tapering into an entire style ca. 6 mm. long, glabrous except at the juncture with the ovary. Fruit not seen.

Some of the outstanding features of this species are: (1) 5-celled sericeous ovary; (2) crowded stamens (ca. 45), with filaments glabrous, the inner two rows geniculate towards the apex, the anthers oblong hirsute, and the apicule long, blunt, glabrous; (3) corolla-lobes glabrous, recurved, connate for nearly one-half their length; (4) style glabrous; (5) bracteoles persistent, opposite, unequal, densely pubescent; and (6) both branches and branchlets densely pubescent.

Melchior, in his key to the species, refers to the filaments as pubescent. My dissections show the filaments to be glabrous, and since King did not mention pubescence in describing the filaments one must assume that he also considered them glabrous. His description proved to be most detailed and accurate.

43. *Adinandra maculosa* T. Anderson ex Dyer in Hooker f., Fl. Brit. Ind. 1: 282. 1874. — King in Jour. As. Soc. Bengal 59 (2): 189 (Mater. Fl. Malay Penin. 1: 129). 1890. — Szyszyłowicz in Nat. Pflanzenfam. III. 6: 189. 1893. — Ridley, Fl. Malay Penin. 1: 195. 1922. — Melchior in Nat. Pflanzenfam. ed. 2, 21: 144. 1925.  
*Ternstroemia* ? *integerrima* Wallich, Cat. no. 1452 (in Herb. Kew, not in Herb. Linn. Soc.). Non T. Anderson.

DISTRIBUTION: Malay Peninsula (Pahang, Penang, Perak).

PAHANG: Fraser's Hill, *E. J. H. Corner* 33170 (A), Aug. 4, 1937. — Fraser's Hill, upon the Selangor border, alt. 1250–1350 m., *M. Nur* 11320 (A), Sept. 1, 1923. PENANG: *N. Wallich* 1452 (TYPE, K). PERAK: Larut, rocky locality, rich soil, alt. 800–1000 m., *Dr. King's Collector* 6331 (A), July 1884 (tree 15–30 m. high; flowers white, dark blue within, with glossy, waxy stamens). Exact locality lacking: *A. C. Maingay* 186 (G).

Tree up to 25 m. high; branches terete, brown, glabrous, the branchlets brown, glabrous, appressed-pubescent near the apex, the terminal buds

small, appressed-pubescent. Leaves heavily coriaceous, elliptic to subrotund, 10–15 cm. long, 4–5 cm. wide, shortly and abruptly acuminate at the apex, tapering at the base, glabrous, shining above, paler, dull, opaque, minutely roughened, generally glabrous beneath, occasionally lightly pubescent along the lower midrib, the margin entire, the veins very indistinct on both surfaces, the petiole ca. 5 mm. long. Flowers axillary, solitary; pedicels ca. 1 cm. long, generally appressed-pubescent; bracteoles 2, persistent, opposite or subopposite, immediately below the calyx-lobes, subrotund, unequal, 2–3 mm. long, appressed-pubescent; calyx-lobes 5, imbricate, appressed-pubescent, unequal, ca. 7 mm. long, the inner lobes pubescent on the central portion of the external surface, thinner and glabrous at the margin; corolla-lobes (fide King) “membranous, ovate, acute, glabrous, connivent”; stamens (fide King) “about 30; filaments attached to the petals, short, glabrous; anthers narrow, the cells elongate, lateral; the connective sericeous with short glabrous apiculus”; ovary depressed-hemispheric, pubescent, 5-celled, multi-ovulate, the style glabrous. Fruit ca. 1 cm. in diameter, globular, at first pubescent, later glabrescent, the seeds numerous, small, shining, dark.

Anderson describes the leaves of this species as “finely mottled beneath with reddish-brown remotely denticulate glabrous.” The leaves of the type are finely but obscurely mottled beneath with reddish brown patches. However, on no other specimen examined did I find the coloration. King (and I depended much on his excellent description) refers to the under surface of the leaf as “pale brown, dull, opaque, minutely rugulose when dry.” This species seems most closely related to *A. integerrima* T. Anders. which has silky pubescent terminal buds and thinner leaves. In *A. maculosa*, the leaves are unusually thick, with the veins obscure, if at all obvious, on both surfaces.

Characters which are helpful in determination are: (1) thick glabrous leaves, opaque beneath and very abruptly acuminate; (2) corolla-lobes glabrous; (3) bracteoles persistent, subrotund and pubescent; (4) ovary densely pubescent, 5-celled with the style glabrous; and (5) filaments glabrous.

44. *Adinandra nunkokensis*, sp. nov.

Ramuli tereti, brunnei, pubescentes, gemmis terminalibus, conicis, dense sericeis. Folia coriacea, elliptico-obovata, 8–14 cm. longa, 2.5–4.5 cm. lata, apice acuminata, basi acuta, supra glabra nitida, subtus leviter adpresso-pubescentia, margine leviter denticulata, nervis lateralibus primariis 6–8 paribus, gracilibus intra marginem anastomosantibus, venis secundariis inter primarias frequentibus, petiolis 4–7 mm. longis, supra planis glabris, subtus semi-teretibus, dense pubescentibus. Flores axillares, solitarii vel bini; pedicellis rugulosis, brevioribus crassioribusque, ca. 5 mm. longis, 4 mm. crassis, recurvatis, leviter adpresso-pubescentibus; bracteolis 2, alternatis, persistentibus, late ovatis, subaequalibus, ca. 2.5–3 mm. longis et 3 mm. latis, leviter adpresso-pubescentibus; sepalis 5, imbricatis, rugulosis, subrotundatis, ca. 7 mm. longis, 5–6 mm. latis, pubescentibus, margine subscariosis glandulosis; petalis 5, basi connatis, cremeis, oblongis, 12–14 mm. longis, 5–7 mm. latis, medio dorso sericeis; staminibus 30–35, 4-seriatis, inaequalibus, 8–11 mm. longis; filamentis



4–7 mm. longis, in toto connatis, basi ad corollam adnatis, inferne nudis, superne hirsutis, antheris ca. 4 mm. longis, dense hirsutis, vix apiculatis, ovario subgloboso dense sericeo, ca. 4–5 mm. diametro, 2-loculari, pauciovulato, ovulis magnis, stylo gracile, ca. 11 mm. longo, basi hirsuto, superne glabro. Fructus non visus.

DISTRIBUTION: British North Borneo.

BRITISH NORTH BORNEO: Mt. Kinabalu, Mt. Nunkok, alt. 800 m., *J. & M. S. Clemens* 32900 (TYPE, A), April 22, 1933.

This species is related to Airy-Shaw's *A. subsessilis* of Sarawak. Both have two-celled ovaries. Although no fruiting specimen was available for this study, I feel, from the small number and the large size of the ovules, that *A. nunkokensis* will probably have very few seeds. *Adinandra subsessilis* produces two seeds in fruit, one in each cell. The flowers in *A. subsessilis* are nearly sessile, with pedicels only 1–2 mm. long, the bracteoles sepaloid, the calyx-lobes distinctly acute, the stamens uni-seriate and only 4–6 mm. long, and the style 5–6 mm. long. The leaves are more finely acuminate at the apex, the petiole but 2 mm. long, and there are 12–14 pairs of veins, prominent on both surfaces.

In *A. nunkokensis* the flowers are briefly pedicellate, but the pedicels are longer (ca. 5 mm.) than those in *A. subsessilis* and much thicker, the bracteoles are more rounded, the calyx-lobes subrotund, the stamens 4-seriate and 7–11 mm. long, the style 11 mm. long. The leaves are acuminate but not as finely attenuate as in *A. subsessilis*, the petiole 6–8 mm. long and there are only 6–8 pairs of veins.

45. *Adinandra Corneriana*, sp. nov.

Arbor?; ramis teretibus, brunneis, pubescentibus, ramulis crassis, teretibus, brunneis, dense luteo-ferrugineo-pubescentibus, gemmis terminalibus crasso-conicis dense ferrugineo-sericeis. Folia chartacea vel subcoriacea, oblongo-elliptica vel obovata, 14–20 cm. longa, 6–9 cm. lata, apice acuta vel obtusa, leviter acuminata, basi cuneata vel obovata, supra glabra, subtus dense pubescentia, praecipue secundum costam, margine glanduloso-serrata, venis lateralibus 10–12 primariis paribus, leviter conspicuis, gracilibus ad marginem anastomosantibus arcuantibusque, venis secundariis inter primarias frequentibus, petiolis pubescentibus, 4–7 mm. longis. Flores axillares, ut videtur solitarii, pedicellis teretibus, recurvatis, 8–10 mm. longis, dense ferrugineo-sericeis; bracteolis oppositis, persistentibus, late ovatis vel subtriangularibus, inaequalibus, dense ferrugineo-sericeis; sepalis 5, imbricatis, exteriore omnino dense adpresso-pubescentibus, interiore glabris, binis exterioribus subdeltoideis, 6–8 mm. longis et latis, tribus interioribus maioribus, 8–10 cm. longis, 10–11 mm. latis; petalis basi connatis, apice acutis, exteriore luteo-pubescentibus; stamina 30–35, 3- vel 4-seriatis, filamentis connatis, basi corollam adnatis, exteriore dense hirsutis, antheris oblongis, dense hirsutis, ovario semigloboso, hirsuto, 3-loculari, pauciovulato, stylo glabro, circiter 5 mm. longo. Fructus globosi, hirsuti, circiter 8 mm. diametro, 3-loculares, uno semine in quoque loculo, seminibus subplanis, hippocrepiformibus, magnis, nitidis, circiter 5 mm. longis et 3 mm. latis.

DISTRIBUTION: Malay Peninsula (Johore).

JOHORE: Mawai-Jemaluang road (13.5 miles), by stream on hillock, at low alti-

tude, *E. J. H. Corner 29010* (TYPE K, fragment A), Feb. 8, 1935. — Mawai-Jemaluang road (13.5 miles), at low altitude, *E. J. H. Corner 29426* (K), May 13, 1935. — Kayu Ara, Mawai-Jemaluang road, in dry Dryobalanops forest, at low altitude, *E. J. H. Corner 29376* (K), May 5, 1935.

Although three excellent specimens have been collected of this species, the material appears rather sparse. As a result few dissections were made. Since no open flowers were available, the buds were used. Hence I have refrained from recording measurements of such parts as corolla-lobes and stamens which were obviously not fully developed. However, the characters which might be used in a key, other than size, have been recorded above.

The three-celled ovary and fruit, with few ovules and seeds are important characters. The ovary of the bud (*Corner 29010* type) exhibited few large ovules, hence one might anticipate fewer and larger seeds in the fruit. For the study of the fruit *Corner 29376* was used. Here, in both fruits examined, it was found that a single large seed developed in each of the three cells of the fruit. Size is the distinctive element. Otherwise, the seeds were typical of the genus.

All three specimens were collected by E. J. H. Corner in Johore at varying dates during the year 1935. It is a pleasure to name this species *A. Corneriana* in his honor.

46. *Adinandra caudatifolia*, sp. nov.

Arbor ad 35 m. alta; ramis teretibus glabris, griseo-brunneis, ramulis teretibus, glabris, brunneis, ramulis juventutissimis adpresso-pubescentibus, gemmis terminalibus gracilibus, adpresso-sericeis. Folia chartacea, elliptica, 5–8 cm. longa, 2.5–3.5 cm. lata, apice abrupte caudata, basi acuta, obtusa vel subrotundata, supra nitida, glabra, subtus pallidiora glabra, rariter leviter pubescentibus, margine integra vel leviter crenulata, venis primariis ca. 8 paribus, intra marginem anastomosantibus arcuantibusque, petiolis minutis circiter 4 mm. longis, glabris. Flores non visi. Fructus axillares, ut videtur solitarii; pedicellis teretibus, glabris, ca. 2 cm. longis, verruculosis subferrugineis; bracteolis 2, oppositis, persistentibus, minutis circiter 1 mm. longis; sepalis 5, imbricatis, subrotundatis, recurvatis, glabrescentibus, circiter 5–6 mm. longis, 4–5 mm. latis. Fructus globosus, glabrescens, circiter 1.5 cm. longus, 1 cm. latus, 3-locularis, seminibus circiter 9, magnis, subplanis, nitidis, circiter  $7 \times 5$  mm.

DISTRIBUTION: British North Borneo.

BRITISH NORTH BORNEO: Upper Mt. Kinabalu, Penibukan, west ridge, jungle, alt. 1700 m., *J. & M. S. Clemens 50377* (TYPE, A), Nov. 4, 1933 (tree 20 m.; fruit green). — Upper Mt. Kinabalu, Penibukan, east ridge, jungle, alt. 1850 m., *J. & M. S. Clemens 50387* (A), Nov. 13, 1933 (tree 30 m.; fruit brown-purple).

The species, *A. caudatifolia*, as the name signifies, is characterized by the tail-like apex of the leaf. Furthermore, the leaf is chartaceous, rather than coriaceous, as is the case in most species.

The material lacks flowers. The fruit, with its evidence of pubescence both at the apex and base, shows that the ovary had been quite densely pubescent. This pubescence extends up the style. To what extent is not known, since all styles were broken near the base. The fruit is distinctly three-celled and the seeds large (ca.  $7 \times 5$  mm.) and few in number (ca.

3 to each cell). The pedicels are verruculose with subferrugineous swellings.

47. *Adinandra acuminata* Korthals, Verh. Nat. Gesch. Bot. ed. Temminck 109. 1840. — Miquel, Fl. Ned. Ind. 1 (2): 478. 1859; Ann. Mus. Bot. Lugd.-Bat. 4: 103. 1868. — Dyer in Jour. Linn. Soc. Bot. 13: 330. 1873; in Hooker f., Fl. Brit. Ind. 1: 282. 1874. — King in Jour. As. Soc. Bengal 59 (2): 190 (Mater. Fl. Malay Penin. 1: 128). 1890. — Szyszyłowicz in Nat. Pflanzenfam. III. 6: 189. 1893. — Ridley, Fl. Malay Penin. 1: 194. 1922. — Melchior in Nat. Pflanzenfam. ed. 2, 21: 144. 1925.

*Gordonia acuminata* Wallich, Cat. no. 3664 in Herb. Linn. Soc.

*Ternstroemia* ? *coriacea* Wallich, Cat. no. 1453.

*Camellia axillaris* Wallich, Cat., p. 158 (not of Roxb. ex Bot. Reg. 349, see Jour. Linn. Soc. Bot. 13: 330. 1873).

*Polyspora axillaris* Choisy in Mém. Soc. Phys. Hist. Nat. Genève 1: 179 (Mém. Ternstr. 91) 1855. Non Don.

DISTRIBUTION: Malay Peninsula, Sumatra.

MALAY PENINSULA: Johore: Gunong Pulai, alt. 300 m., *M. R. Henderson* 28514 (K), April 29, 1934 (small slender tree 7–8 m. high; flowers white). — Kluang, Forest Ranger (*Abdul Rahim*) 5918 (K), May 3, 1925. — Sedanah, *H. N. Ridley* 13504 (K), Nov. 24, 1908. Perak: Larut, open top of mountain, alt. 1000–1300 m., *Dr. King's Collector* 6289 (K), July 1884 (tree 12–15 m. high; leaves dark glossy green). — *B. Scortechini* 345 (K). — Gunong Butu, Puteh, Lower Camp, alt. 1130 m., *L. Wray* 1158 (K). — Exact locality lacking, *L. Wray* 2804 (US). — Larut, high mountains, alt. 1200–1300 m., *Dr. King's Collector* 6352 (US), July 1884 (tree 20–30 m. high; leaves rich glossy green; fruit grayish brown). Penang: Western Hill, along path, alt. 800–900 m., *M. R. Henderson* 21358 (K), Sept. 21, 1934 (small slender tree). — Government Hill, *A. C. Maingay* 2267 (185) (G, US), Feb. 1867. — Open jungle, hilly locale, alt. 300–600 m., *Dr. King's Collector* 4342 (US), Aug. 1883 (tree 20–30 m. high; leaves dark glossy green; flowers white). Malacca: Garden jungle, *H. N. Ridley* 1952 (A), 11334 (K), 1892 and 1893. Singapore: Bukit Timah, *E. J. H. Corner* 34932 (A, K), April 12, 1938. — Common, *H. J. Murton* 111 (G, K), Dec. 1878. Pahang: Enden, *F. G. Mohamud* 15518 (K), Aug. 31, 1929.

SUMATRA: Exact locality lacking, *P. W. Korthals* s. n. (probable ISOTYPES, G, US), 1864.

Small tree up to 25 m. high; branches brown-gray, terete, glabrous, the branchlets glabrous except for the appressed pubescence on the current year's growth, the terminal buds elongated, densely sericeous. Leaves coriaceous, oblong-elliptic to broadly ovate, 8–15 cm. long, 4–5 (–6) cm. wide, generally sharply and finely acuminate (up to 3 cm. long) at the apex, occasionally less prominent, acute at the base, glossy, dark green, glabrous above, somewhat paler, glabrous or scattered-pubescent beneath, the margin entire or obsoletely denticulate, the veins ca. 12 pairs, usually with double arching, not always, the petiole ca. 5 mm. long. Flowers axillary, solitary or in twos; pedicels terete, ca. 1 cm. long, finely appressed-pubescent at first, later glabrescent, smooth at anthesis, later developing wart-like protuberances becoming very rough and pronounced at the fruiting stage; bracteoles 2, persistent, alternate along the pedicel, the upper one not close to the calyx, small triangular, ca. 1 mm. long, usually appressed-pubescent; calyx-lobes 5, imbricate, finely appressed-pubescent, unequal, ca. 6–7 mm. long, the outer two lobes narrower, ca. 3 mm. wide, the inner three lobes more rounded ca. 5.5 mm. wide; corolla-lobes 5, connate at the base, rounded at the apex, ca. 10 mm. long, 7 mm. wide,



lightly appressed-sericeous on the median portion of the external surface; stamens seemingly 4-seriate, unequal in length, up to 10 mm. long, the filaments adnate to the base of the corolla, connate the length of the shortest stamen, free from that point, lightly pubescent on the inner surface, the anthers elongate, short-hirsute; ovary conical, densely pubescent, ca. 3 mm. across, 3-celled, pauci-ovulate, tapering at the apex into an entire style 7-8 mm. long, pubescent nearly to the apex. Fruit quite globose, up to 2 cm. diameter, glabrescent with evidence of pubescence near the apex, few-seeded, the pedicel at this stage rugged and warty, the seeds light in color, ca. 6 mm. long.

Until borrowed material from Kew was obtained this species presented considerable difficulty. In the original description, Korthals stated that the sepals were glabrous and the fruit 4- or 2-celled. My study revealed the sepals to be distinctly appressed-pubescent and the ovary definitely 3-celled. However, these conclusions were drawn from Malayan material rather than Sumatran. Dyer, in Hooker f., *Fl. Brit. India*, 1: 282. 1874, stated also that the sepals and the leaves were glabrous. Later King (*Jour. As. Soc. Bengal* 59 (2): 190 [*Mater. Fl. Malay Penin.* 1: 128]. 1890) remarked that the species was glabrous in all parts except the stamens, and Ridley (*Fl. Malay Penin.* 1: 194. 1922) gave the same impression.

From all the material examined I find the species to be quite pubescent. Korthals gave this impression in his description, and authentic Korthals specimens from Sumatra, although lacking both flowers and fruit, show the young branchlets, buds and leaves to be pubescent.

At first I felt that the British botanists were misinterpreting Korthals' species and perhaps were working with an entirely different species. However, the material from the Kew herbarium agreed with our own specimens in all instances, some actually being duplicates. The young branchlets, buds, under surface of leaves, pedicels, bracteoles, calyx-lobes, corolla-lobes, stamens, ovary and style are all pubescent in varying degrees. The leaves, calyx-lobes, pedicels, bracteoles and fruit tend to become glabrescent.

The apex of the leaves of the Sumatran material is much more fine- and long-acuminate than the apex of those of the Malayan material. In some of the Korthals specimens the acumen is drawn out to as much as 3 cm. and appears somewhat caudate. In the Malayan material, although definitely acuminate, the leaves are seldom as distinctive. Some workers have placed stress on the double arching of the veins of the leaves. This character varies considerably and is hardly stable. Also the wart-like condition of the fruiting pedicel has been stressed. As striking as this character happens to be, it is not found in the flowering material, for some reason not appearing until the developing fruit stage.

Other characters which may be used in determination are (1) the alternate, small, persistent, triangular bracteoles; (2) the pubescent calyx-lobes and corolla-lobes; (3) the pubescent filaments joined the length of the shortest filament in series; (4) the pubescent, 3-celled ovary, pauci-ovulate, and the 3-celled fruit, few and large seeded; and (5) the entire style pubescent almost to the apex.

The synonymy cited above is merely quoted from Dyer in Hooker f. *Fl. Brit. India*, 1: 282. 1874. It has not been possible for me to verify these names. However, I wish to have them quoted here as a record.

VERNACULAR NAMES: *Kelat, Membasah.*

48. *Adinandra integerrima* T. Anderson ex Dyer in Hooker f., *Fl. Brit. Ind.* 1: 282. 1874. — King in *Jour. As. Soc. Bengal* 59 (2): 190 (*Mater. Fl. Malay Penin.* 1: 130). 1890. — Szyszylowicz in *Nat. Pflanzenfam.* III. 6: 189. 1893. — Ridley, *Fl. Malay Penin.* 1: 196. 1922. — Melchior in *Nat. Pflanzenfam.* ed. 2, 21: 144. 1925. — Craib, *Fl. Siam. Enum.* 1: 125. 1925.

*Adinandra dasyantha* Choisy in *Mém. Soc. Phys. Nat. Genève*, 1: 112 (*Mém. Ternstr.* 24). 1855. — Non Korthals.

*Ternstroemia integerrima* Wallich, *Cat. no.* 1452, in *Herb. Linn. Soc.*

*Ternstroemia reticulata* Wallich, *Cat. no.* 2246.

*Gordonia reticulata* Wallich, *Cat. no.* 3663.

*Camellia japonica* Wallich, *Cat. no.* 3667, in *herb. Kew*, not in *Herb. Linn. Soc.*

*Adinandra integerrima* Pierre var. *a nigro-punctata* Pierre, *Fl. For. Cochinchine* 2: t. 125. 1887.

DISTRIBUTION: Malay Peninsula.

PENANG: *N. Wallich 3663* (TYPE, K). JOHORE: *H. N. Ridley 6336* (K). PAHANG: Sungei Yet., Bukit Fraser, alt. 1250 m., *Native Collector 11149* (A), Sept. 29, 1923. Exact locality lacking, *N. Wallich 3667* (K).

Small tree; branches terete, brown-gray, the branchlets appressed-fulvous-pubescent, the very young branchlets of current year's growth densely so, the terminal bud densely fulvous-pubescent. Leaves subcoriaceous or coriaceous, ovate to oblong-ovate to oblong-elliptic, 8–13 cm. long, 4–5 cm. wide, acuminate at the apex, usually acute at the base, occasionally somewhat rounded, the upper surface shining, glabrous, lower surface paler in color, sparsely pubescent (especially on the midrib) and covered with minute dark dots, the margin glandular-denticulate, the veins 10–12 pairs, slightly conspicuous on both surfaces, the petiole 5–7 mm. long, flat above, rounded beneath, pubescent. Flowers axillary, solitary; pedicel up to 1 cm. long, appressed-pilose; bracteoles 2, persistent, opposite, immediately below the calyx, pubescent, unequal, the smaller ca. 2 mm. long, acute, the larger more rounded; calyx-lobes 5, imbricate, densely sericeous, unequal, the two outer lobes larger ca. 7–8 mm. long at anthesis, broadly ovate, thick, the margin thin, denticulate, accrescent, up to 1 cm. long in fruit; corolla-lobes 5, connate at the base, ca. 1 cm. long, lightly sericeous on the upper median portion of the external surface, otherwise glabrous; stamens seriate, ca. 40, adnate to the base of the corolla, the filaments united for the most part, ca. 2 mm. long, glabrous, the anthers ca. 3 mm. long, hirsute, the apicule 1+ mm. long; ovary depressed-hemispheric, appressed-sericeous, 5-celled, multi-ovulate, the style sericeous. Fruit appressed-pubescent, 1.75 cm. diam. (fide Dyer), the seeds small, many.

Authentic material, *Wallich 3663, 3667*, original collections of the species loaned from Kew, were used in drawing up the above description. The synonymy cited above is borrowed from Anderson in Hooker f., *Fl. British India*. No opportunity has been afforded me to actually study the specimens cited as synonyms. They are listed here in compilation.

Characters helpful in determination are: (1) fulvous-pubescent branchlets; (2) short, recurved pedicels, seldom over 1 cm. long; (3)

persistent bracteoles, unequal and opposite; (4) calyx-lobes densely sericeous, the two outer lobes often appearing as a single huge bract; (5) short corolla-lobes, sericeous near the apex of the median portion of the external surface; (6) glabrous filaments and oblong short-hirsute anthers, the apicule over 1 cm. long; and (7) ovary and fruit 5-celled, densely sericeous.

49. *Adinandra collina*, sp. nov.

Arbor parva; ramulis teretibus, glabris, griseo-brunneis, gemmis terminalibus elongatis, glabris (costis marginibusque exceptis). Folia coriacea, elliptico-oblonga, 8–10 cm. longa, 3–4.5 cm. lata, apice subrotundata abrupte acuminata, basi cuneata, supra glabra, subtus glabra costa excepta, costa supra plana, subtus elevata, glabra vel leviter pubescente, ut videtur bisulcata, margine subintegra, minutissime serrulato-crenulata, nervis undique obscurissimis, petiolis glabris, 6–8 mm. longis. Flores axillares, solitarii vel bini; pedicellis glabris, circa 1 cm. longis, apice recurvatis; bracteolis 2, persistentibus, glabris rare leviter pubescentibus ciliolatisque, inaequalibus, alternatis, inferiore minoreque late ovata, circa 2 mm. longa et 2.5 mm. lata, superiore maioreque subrotundata, circa 3 mm. longa et 2.5 mm. lata; sepalis 5, imbricatis, glabris, ciliolatis, inaequalibus, exterioribus 2 late ovatis, circa 4 mm. longis et 5 mm. latis, interioribus 3 subrotundatis, 5–6 mm. longis et 5–7 mm. latis; petalis 5, basi connatis, oblongo-obovatis, glabris, inaequalibus, 16–18 mm. longis, 5–7 mm. latis, apice rotundatis, abrupte apiculatis, apiculis circa 2 mm. longis; staminibus circa 30, ?-seriatis, inaequalibus, 12–15 mm. longis, filamentis 7–9 mm. longis, basi breviter connatis et petalis brevissime vel vix adnatis, ad apicem accrescentibus, inferne nudis, superne pubescentibus, antheris oblongis, albido-hirsutis, 4–5 mm. longis, apiculis glabris, circa 0.5–1 mm. longis; ovario subgloboso, glabro, circa 4 mm. diametro, apice abrupte attenuato, 5-loculari, multi-ovulato, stylo glabro, elongato, circa 1 mm. longo, stigmatibus minuto. Capsula subglobosa, glabra, circa 1 cm. diametro, 5-locularis, multi-seminata; semina discoidea, castanea, nitidula, circa 2 mm. diametro.

DISTRIBUTION: Sarawak, British North Borneo, Borneo.

SARAWAK: Kuching, *G. D. & C. Haviland 852* (TYPE, G), Dec. 1892. — Mount Matang, near bungalow, *J. & M. S. Clemens 20986 (7447)* (A), Oct. 24, 1929 (tree 12 m. high; flower-buds cream-colored). — *Sarawak Museum (Native Collector) 136* (A, G, US), 1768 (A, US), 1957 (A, G), 5135 (A, NY, US). BRITISH NORTH BORNEO: Mt. Bungal, *M. S. Clemens 11200* (A), Dec. 9–10, 1915. — Kibayo to Keung, Keung trail, *M. S. Clemens 9882* (A, PBS), Oct. 29, 1915. — Sunsuron, Tamboenan, hilltop, alt. 450 m., *Puasa-Angian (British N. Borneo For. Dept. no. 3938)* (A, K), Feb. 10, 1934 (tree 10 m. high; fruit green). — *H. Low s. n.* (G). — Mt. Kinabalu, Dallas, alt. 1000 m., *J. & M. S. Clemens 26853* (A), Oct. 23, 1931 (flowers cream-colored; fruit green). BORNEO: Sanggouw, *H. Hallier 950* (NY), 1893–94. — Boorbeo (southeast Borneo), West Koetai, alt. 30 m., *Neth. Ind. For. Serv. b.b. 16153* (A), Nov.–Dec. 1931.

In many characteristics, *A. collina* resembles *A. verrucosa* Stapf, to which it is closely related. Both have bisulcate midribs on the under surface of the leaf, the more noticeable in *A. verrucosa*. Both species are quite glabrous and resemble *A. dumosa* Jack in this respect. However, the two Bornean species have pubescence on the young terminal buds whereas in *A. dumosa* the terminal bud is always strictly glabrous.



In *A. verrucosa* the leaves are larger, coarser, obtuse and bluntly emarginate at the apex, the midrib beneath is always glabrous. In *A. collina* the leaves are acuminate at the apex and a fine pubescence is found along the midrib on the under surface. The branchlets in the former species are very thick, measuring up to 4 and 5 mm. in diameter near the apex. In *A. collina* the branchlets are smooth, terete and measure only 1–2 mm. in diameter. The petiole in *A. verrucosa* is short and sturdy and when breaking off from the branchlets leaves a large scar. The pedicels are very short and thick, seldom measuring over 5 mm. long, and often measuring the same in thickness. In *A. collina* the pedicels measure up to 2 cm. or more (1 cm. in type), and are comparatively slender. The corolla-lobes of *A. verrucosa* measure 10–12 mm. in width while in those of *A. collina* the measurement is 6–8 mm. in width. *Adinandra verrucosa*, to date, has been found only in the "upper-mountain" zone (6000–10500 ft.), of Mt. Kinabalu, as defined by Stapf, whereas *A. collina* is found at low altitudes of less than 1000 ft. in the "hill-zone." In the latter species, the majority of specimens cited were collected in Sarawak.

In *A. dumosa*, as far as I have seen, there is no tendency toward pubescence. The terminal bud is strictly glabrous. The terminal bud seems to be a criterion of this variable tendency toward pubescence. In species where the terminal bud is pubescent, especially when the pubescence is of the appressed nature, there is a distinct tendency toward glabrescence. As a result, one may find varying degrees of pubescence on the leaves and floral parts, making it quite difficult to use the character of pubescence in a key or as a delimiting factor.

This same situation occurs in *A. collina*. The terminal leaf-bud is quite glabrous, yet one can find pubescence along the bisulcate midrib (which character is very obvious in the unfolding leaves) and along the margin. In the type cited above the specimen is quite glabrous and one must look most carefully to see evidences of pubescence. In other collections of the species, one may find distinct pubescence on the lower surface of the leaves and on the pedicels, bracteoles and calyx-lobes.

VERNACULAR NAME: *Bangkao* (Dusun).

50. *Adinandra Clemensiae*, sp. nov.

Arbor magna; ramis ramulisque teretibus, glabris brunneis vel griseo-brunneis, gemmis terminalibus minutis, conicis, sericeis. Folia chartacea vel subcoriacea, subrotundata, obovata vel elliptico-oblonga, 3.5–5 × 2–2.5 cm. (6–7 × 3–4.5 cm.), apice subrotundata, obtusata vel late obovata, basi late cuneata vel acuta, glabra, subtus fusco-punctata, margine subintegra, subrevoluta, venis supra obscuris, subtus 6–8 lateralibus primariis paribus intra marginem anastomosantibus, petiolis glabris, 6–9 mm. longis. Flores axillares, solitarii; pedicellis glabris, ca. 1 cm. longis, recurvatis; bracteolis 2, oppositis, persistentibus, glabris, juventute dense pubescentibus, inaequalibus, minore ca. 2 × 2.5 mm., apice rotundato, majore ca. 2 × 5 mm., apice rotundato; sepalis 5, imbricatis, pubescentibus, inaequalibus, tribus exterioribus crassioribus, pubescentioribus, 7–9 mm. longis, 6–8 mm. latis, subrotundatis, margine non scariosis, duobus interioribus, subellipticis, ca. 7 mm. longis, 5–6 mm. latis, margine

scariosis, ciliolatis; petalis 5, albis, basi ad 5 mm. connatis, glabris, obovato-oblongis, 15–16 mm. longis, ca. 5 mm. latis, apice obovatis vel subrotundatis; staminibus ca. 25, 3-seriatis, 9–11 mm. longis, filamentis 5–7 mm. longis, basi ad corollam adnatis, integre connatis, hirsutis, interioribus geniculatis, antheris oblongis, ca. 4 mm. longis, hirsutis, non apiculatis; ovario subgloboso, dense sericeo, circiter 3 mm. diametro, 5- (vel 4-) loculari, loculis multi-ovulatis, stylo circiter 14 mm. longo, glabro, basi sericeo. Fructus (*J. & M. S. Clemens 31385*) subglobosus, sericeus, ca. 10 mm. longus et 8 mm. diametro, 5-locularis, multi-seminatus; semina typica, nitida, ca. 2.5 mm. diametro.

DISTRIBUTION: British North Borneo (Mt. Kinabalu).

BRITISH NORTH BORNEO: Mt. Kinabalu: Tenompok, alt. 1650 m., *J. & M. S. Clemens 28453* (A), Feb. 7, 1932 (flowers cream tinged with purple).— Tenompok, alt. 1650 m., *J. & M. S. Clemens 28618* (A), March 2, 1932 (buds green; flowers cream tinged with pink, centers brown).— Dallas, alt. 1000 m., *J. & M. S. Clemens 29359* (A), April 28, 1932 (flower-buds green tinged with purple).— Tenompok, alt. 1650 m., *J. & M. S. Clemens 30193* (A), Feb. 17, 1932 (flowers cream tinged with purple).— Dallas, alt. 1000 m., *J. & M. S. Clemens 30194* (A), April 28, 1932. — Tenompok, alt. 1650 m., *J. & M. S. Clemens 30201* (A), May 3, 1932 (flowers green with cream-colored pistils). — Penibukan, alt. 1350–1650 m., *J. & M. S. Clemens 31385* (A), Feb. 7, 1933 (tree 7 m. high). — Colombon River, alt. 1850 m., *J. & M. S. Clemens 32603* (A), June 16, 1933 (flower-bud pinkish). — Marai Parai, alt. 1650 m., *J. & M. S. Clemens 33071* (A), May 3, 1933. — Colombon River, alt. 2350 m., *J. & M. S. Clemens 33773* (A), June 28, 1933 (flower-buds dull pink; fruit green). — Colombon River, alt. 2000–2350 m., *J. & M. S. Clemens 33906* (A), July 12, 1933. — Colombon River, alt. 1850 m., *J. & M. S. Clemens 34090* (A), July 19, 1933 (flowers with pink tinge, the anthers brown, the pistil white). — Colombon River, alt. 1850 m., *J. & M. S. Clemens 34480* (TYPE, A), Aug. 10, 1933 (flowers white becoming dull salmon). — Colombon River basin, alt. 1500 m., *J. & M. S. Clemens 40122* (A), Aug. 24, 1933 (flowers white, the sepals and anthers purple-tinged). — Penibukan, jungle, alt. 1350 m., *J. & M. S. Clemens 50516* (A), Nov. 3, 1933 ("big tree"; style long; fruit gray). — Gurulau, crest of spur, alt. 1650 m., *J. & M. S. Clemens 50692* (A), Dec. 4, 1933 (tree 25 m. high; style elongated; fruit green). — Gurulau spur, mossy forest, alt. 2650 m., *J. & M. S. Clemens 50979* (A), Dec. 12, 1933 (small tree with gray fruit).

From the collections made on Mt. Kinabalu in British North Borneo by *J. & M. S. Clemens*, this species seems to be the most widespread in that area. Collections were obtained from Dallas, at 3000 ft. altitude, Tenompok, Penibukan, Marai Parai and Colombon River at 5000 ft. altitude and Gurulau spur at 5000 and 8000 ft. altitude. All specimens were collected at approximately 5000 ft. altitude with the exception of two from Dallas at 3000 ft. and one from Gurulau spur at 8000 ft. In most species of the genus the flower is white. In this species is found considerable variation in color ranging from a purple-tinge through salmon and pink to pure white. Color in the stamens is also mentioned.

The name *A. Clemensiae* is selected in honor of *Mrs. M. S. Clemens* who not only collected all the specimens cited for this species but many more specimens representative of various other species in this genus.

The ovary in the type-specimen, *J. & M. S. Clemens 34480* is more often four-celled than five-celled. At least, this was the case in the several dissections made for this study. However, a single dissection from *Clemens 40122*, collected in the same general locality, showed a five-celled

ovary. These two specimens, of all those cited above, are the only two in the flowering stage. The majority of specimens, obviously the same species, are in the bud stage. These buds, although sufficient for specific determination, are very unsatisfactory for ovary-dissections. Two specimens *J. & M. S. Clemens* 50156 and 50979 are in the fruiting stage. From no. 50156, three fruits have been laboriously sectioned from apex to base. Although to all appearances these fruits are normal, they proved to be solid and woody throughout with only occasional slits where cells might have been expected. In *J. & M. S. Clemens* 50979 the fruit is found to be distinctly three-celled with few developed seeds. In this specimen the walls between the cells are very thick. Considering the fact that in most fruits the cell-walls are so fragile that it is often difficult to observe them with certainty, this thick-walled condition is most unusual. One may assume from these observations that *A. Clemensiae* may have an ovary with the number of cells varying from three to five.

The third fruiting specimen (*J. & M. S. Clemens* 31385) shows clearly a five-celled fruit with many seeds developed typical of the genus. In this specimen the cell-walls are thinner than those found in *J. & M. S. Clemens* 50979.

The small, thin, somewhat rounded leaves with long petioles present a character which makes this species easily recognizable.

51. *Adinandra magniflora*, sp. nov.

Arbor parva; ramis et ramulis teretibus, glabris, brunneis, innovationibus glabrescentibus vel leviter pubescentibus, gemmis terminalibus conicis, adpresso-pubescentibus. Folia coriacea, elliptica, 6–13 cm. longa, 4–7 cm. lata, apice abrupte lateque acuminata, basi late cuneata vel subrotundata, supra glabra, subtus fusco-punctata, glabra vel leviter pubescentia, margine integra, venis supra obscuris, subtus lateralibus primariis 8–10 paribus prominentibus, margine anastomosantibus arcuantibusque, venis secundariis inter primarias frequentibus, petiolis crassis, 2–4 mm. longis, glabris. Flores axillares, solitarii; pedicellis teretibus, crassis, 1–1.5 cm. longis, adpresso-pubescentibus; bracteolis 2, oppositis, subrotundatis, adpresso-pubescentibus, inaequalibus, circiter  $5 \times 6$  mm. et  $6 \times 8$  mm.; sepalis 5, imbricatis, subrotundatis, inaequalibus, 10 mm. longis, 9–11 mm. latis, interioribus margine scariosis; petalis 6, albidis, imbricatis, basi connatis, glabris, circiter 20 mm. longis, 8–10 mm. latis, apice obtusis vel subrotundatis; staminibus circiter 45, ut videtur 4-seriatis, 10–17 mm. longis, filamentis ad basim liberis, basi ad corollam adnatis, pubescentibus, 6–10 mm. longis, interioribus ad apicem accrescentibus, exterioribus gracilibus non accrescentibus, antheris linearibus, 4–5 mm. longis, hirsutis; ovario subgloboso, sericeo, 5-sulcato, 5-loculari, multi-ovulato, stylo gracile, glabro, circiter 15 mm. longo. Fructus elongato-globosus, sericeus, circiter 12 mm. longus, 8 mm. diametro, 5-locularis, multi-seminatus; semina rubra, minuta, 1.5 mm. vel minus longa et 1 mm. diametro.

DISTRIBUTION: British North Borneo.

BRITISH NORTH BORNEO: Mt. Kinabalu: Tenompak, alt. 1650 m., *J. & M. S. Clemens* 29596 (A), May 7, 1932 (flowers cream-colored, the buds green).—Penibukan, canyon west of jungle, alt. 1350 m., *J. & M. S. Clemens* 32040 (A), March 10, 1933.—Head of Dahobang, alt. 2000–2300 m., *J. & M. S. Clemens* 32931 (TYPE, A), April 23, 1933 (flowers white).—Colombon River, alt. 1850 m., *J. & M. S. Clemens* 33482 (A), Aug. 10, 1933 (flowers white with bright pink stamens).



When present, the open flowers of this species furnish the most outstanding character. The corolla is large, measuring 3 cm. across, white in color, glabrous, and the six individual lobes are 2 cm. in length. This is the only instance of a corolla with six lobes. Only two flowers were observed in detail, one each from *J. & M. S. Clemens 32931*, the type, and *J. & M. S. Clemens 34482*. In both cases six lobes were observed. Whether this number is uniform is questionable! According to the collectors, the stamens are "brick pink."

In this species and in *A. impressa* it is difficult to ascertain the number of cells in the fruit. In both species there is a similarity in the minute red seeds, which are so crowded in the fruit that they have penetrated the central axis, and the cell-walls appear to have been broken from the sides of the fruit. Also, in both cases, the placentae of the ovary (where it is easy to distinguish the five cells) appear blunt, with the many ovules nearly completely encircling the placentae.

In keeping with the size of the other parts of the flower, the stamens are long. The filaments are free from each other their entire length, except at their base where they are adnate to the base of the corolla. The filaments of the inner or shorter stamens are somewhat geniculate and enlarged at their juncture with the anthers. However, in the longer or outer stamens, the filaments are very straight and uniform in width.

Cited here dubiously are *J. & M. S. Clemens 32610* and *51673* collected on Mt. Kinabalu. Both specimens appear to belong to this species. However, both are specimens with smaller leaves and both are incomplete, making a true association uncertain.

52. *Adinandra plagiobasis* Airy-Shaw in Kew Bull. Misc. Inform. 1939: 504. 1939.

DISTRIBUTION: Sarawak.

SARAWAK: Mt. Dulit (Ulu Tinjar), near Long Kapa, on side of steep ridge in primary rain-forest, alt. 500 m., *P. W. Richards 1191* (ISOTYPE, A) Aug. 10, 1932 (tree 90 m. high, circumference 1.7 m. at 1.5 m. from ground, no buttresses, bark about 6 mm. thick, reddish, smooth with very numerous lenticels arranged in transverse rows, wood pale yellow; leaves gland-dotted).

Tree 27 m. high; branchlets terete, somewhat rugulose, brown, with a thin but dense pubescence, the individual hairs measuring up to 1.5 mm. in length, the terminal bud with the same pubescence. Leaves subcoriaceous, oblong-elliptic or sub lanceolate, 8–12 (–16, fide Airy-Shaw) cm. long, 2–3.5 cm. wide, acuminate at the apex, oblique-cordate at the base, always glabrous above, spreading pubescent beneath, densely pubescent on the younger leaves (as on the young branchlets), concentrated on the midrib, punctate-dotted, the midrib impressed above, prominent beneath, the veins inconspicuous above, more obvious beneath, ca. 15 pairs, the margin finely serrulate (evident on the lower surface only), the petiole very brief, 3 mm. or less long, the pubescence continued from the midrib. Flowers axillary, solitary; pedicels usually curved, 1.5–2 cm. long, thickened toward the apex, the pubescence similar to that of the branchlets; bracteoles 2, caducous, alternate, 3–5 mm. distant from calyx; calyx-lobes 5, imbricate, ovate, ca. 10 mm. long, 6–7 mm. wide, the outer sepals laxly pubescent, the inner sepals more densely so; corolla-lobes 5, connate at the base, obovate, ca. 13 mm. long (2 cm., fide Airy-Shaw), ca. 10 mm. wide,

sericeous on the middle portion of the external surface, glabrous within; stamens nearly 50, in series, the filaments varying in length, 2–3 mm. long, sericeous on the external surface except on the lower portion where they are adnate to the corolla-lobes, the anthers 4–6 mm. long, sericeous; ovary at first truncate then tapering at the apex rather than conical, sericeous, ca. 3 mm. diam., 5-celled, multi-ovulate, the style 8–9 mm. long, sericeous at the base, otherwise glabrous. Fruit not seen.

The oblique, cordate base of the leaves is an unusual character in this genus and the most distinguishing feature of the species. In this character and in the leaf-texture is found a striking resemblance to the species of the American genus *Freziera*. The leaves of *A. cordifolia* Ridley, from Sarawak and British North Borneo, also have a cordate base. However, as Airy-Shaw states in his presentation, the true relationship of *A. plagiobasis* is rather with *A. villosa* Choisy and *A. coarctata* Craib, which agree in indumentum and general leaf-outline. The indumentum in this species is unusual in that it is longer and more lax than the usual appressed type of pubescence found in the majority of species of the genus.

My material of *Richards 1191* is probably less copious than that from which Airy-Shaw drew his description. In the material examined here, the corolla-lobes measured only 13 mm. in length. Those described from the same number by Airy-Shaw measured 20 mm. long. I depended on a single flower for dissection, which, however, was in excellent condition.

VERNACULAR NAME: *Pungo* (Laban).

53. *Adinandra borneensis*, sp. nov.

Arbor ?; ramis teretibus, verrucosis, glabrescentibus, rubro-brunneis, ramulis teretibus, verrucosis, luteo-adpresso-pubescentibus, gemmis terminalibus dense luteo-adpresso-pubescentibus. Folia coriacea, elliptica vel obovata, 10–16 cm. longa, 4.5–6 cm. lata, apice abrupte acuminata vel subrotundata, basi cuneata, supra glabra, subtus adpresso-pubescentia, fusco-punctata, margine integra, venis supra obscura, subtus lateralibus primariis 20+ paribus, vix distinctis vel obscuris, petiolis 3–5 mm. longis, subtus pubescentibus. Flores axillares, solitarii; pedicellis circiter 2 mm. longis, adpresso-pubescentibus; bracteolis 2, alternatis, cito caducis; sepalis 5, imbricatis, circiter 10 mm. longis, inaequalibus, exterioribus duobus subrotundatis, 9–10 mm. latis, omnino adpresso-pubescentibus, interioribus tribus ovatoribus, apice subrotundatis, 8–9 mm. latis, adpresso-pubescentibus margine scariosis glabris; petalis 5, basi connatis, circiter 13 mm. longis, 9 mm. latis, omnino dense sericeis, apice rotundatis; staminibus 45–50, 4- vel 5-seriatis, 7–11 mm. longis, filamentis connatis, basi ad corollam adnatis, hirsutis, interioribus ad apicem geniculatis vel accrescentibus, exterioribus gracilibus, antheris elongatis, hirsutis, apiculatis, ovario sericeo, subgloboso, 5-loculari, multi-ovulato, stylo 5 mm. longo, glabro, stigmatibus 5-lobis. Fructus non visi.

DISTRIBUTION: Netherlands East Indies (Southeast Borneo).

SOUTHEAST BORNEO: Above Mahakam Hitaja, at sea level, *Neth. Ind. For. Serv. b.b. 20641* (TYPE, K), Feb. 1, 1936.—Above Makaham [sic], Long Loeboeng, alt. 35 m., *Neth. Ind. For. Serv. b.b. 20601* (A), Jan. 23, 1936.

This species is most closely related to another Bornean species, *A.*

*myrioneura* Kob., which has been collected from an approximate locality. Both have leaves with more than twenty pairs of primary veins. In the leaves of *A. myrioneura* the veins are very distinct on the under surface and rise at nearly right angles from the midrib. In *A. borneensis* the veins are quite indistinct on both surfaces and rise at a less erect angle from the midrib.

Also, *A. myrioneura* has a four-celled ovary, the style is pubescent, the corolla glabrous and the leaves are more chartaceous. In *A. borneensis*, the ovary is five-celled, the style glabrous, the corolla pubescent, and the leaves are coriaceous.

In the ovary of both species the placentae are split. In *A. borneensis* the outer cell-wall projects in between the branched placentae and extends nearly to the central axis giving the appearance of ten cells, in some instances.

Cited above is a sterile specimen collected by the Neth. Ind. For. Serv. (20601). The leaves are larger than those of the type. From general appearances this specimen agrees with the type and is mentioned in this paper for herbaria where perhaps the specimen may be in the flowering or fruiting stage.

54. *Adinandra dasyantha* Korthals, Verh. Nat. Gesch. Bot. ed. Temminck, 108. 1840. — Choisy in Mém. Soc. Phys. Hist. Nat. Genève, 1: 112 (Mém. Ternstr. 24). 1855. — Miquel, Fl. Ned. Ind. 1 (2): 477. 1859; Ann. Mus. Bot. Lugd.-Bat. 4: 103. 1868. — Szyszylowicz in Nat. Pflanzenfam. III. 6: 189. 1893. — Melchior in Nat. Pflanzenfam. ed. 2, 21: 144. 1925.

DISTRIBUTION: Netherlands East Indies (Sumatra).

SUMATRA: Exact locality lacking, *P. W. Korthals s. n.* (probable ISOTYPES, G, NY). — Tapanoeli, Angkola in Sipirok, Panoban, alt. 500 m., *Neth. Ind. For. Serv. b.b.* 28194 (A), June 21, 1939. — East Coast, Asahan, vicinity of Loemban Ria, *Rahmat Si Boeea* 7607 (US), Feb.-April 1935.

Tree 8 m. high; branches erect, open, terete, pale gray, glabrous; branchlets terete, densely pubescent, terminal bud densely sericeous. Leaves coriaceous, usually oblong-ovate, occasionally obovate, somewhat acute at the apex, acute at the base, ca. 10–13 cm. long, 3–4 cm. wide, the margin entire or obsoletely crenulate, glabrous above, densely pubescent along the midrib beneath, the young leaves pubescent beneath, the petiole ca. 5 mm. long, somewhat terete, flattened above, pubescent. Flowers axillary, solitary; peduncles terete, ca. 1 cm. long, thickened near the apex, pubescent; bracteoles 2, alternate near top of pedicel, caducous, pubescent; calyx-lobes 5, imbricate, subequal, rotund, ca. 6 mm. long and wide, pubescent on the external surface, membranaceous and glabrous at the margin, ciliolate; corolla-lobes 5, obovate, obtuse, densely sericeous on the external surface, glabrous within, fleshy, white, ca. 14 mm. long, 10 mm. wide; stamens in series, numerous; filaments joined at the base, partly free, linear, glabrous, the anthers oblong, acute, densely hirsute; ovary hemispherical-conical, pubescent, attenuate at the apex into a glabrous terete style; stigma truncate. Fruit glabrous, somewhat globose, attenuate at the apex into the persistent glabrous style, 5-celled, many-seeded.

Judging from the material available for study, this species appears very



rare and seems confined to the island of Sumatra. Three probable isotypes collected by Korthals in Sumatra, in addition to a single specimen collected by Rahmat Si Boeea in the East Coast region of Sumatra constitute the total material for this study.

Characters helpful in determination of the species are: (1) glabrous ovary and style; (2) glabrous filaments; (3) dense sericeous pubescence of the corolla-lobes; (4) caducous bracteoles; and (5) pubescent terminal buds, branchlets and midrib of the under surface of the leaves.

VERNACULAR NAME: *Kajoe api-api*.

55. *Adinandra myrioneura*, sp. nov.

Arbor 12 m. alta; ramis teretibus, lenticellatis, griseo-brunneis, glabrescentibus, ramulis juventutibus teretibus, sericeis, lenticellatis, gemmis terminalibus dense luteo-ferrugineis. Folia chartacea, oblongo-ovata vel oblongo-elliptica, 10–13 cm. longa, 3.5–5 cm. lata, apice late acuta, abrupte obtuseque acuminata, basi late cuneata vel subrotundata, supra glabra, subtus leviter pubescentia vel glabrescentia, margine integra vel subintegra, venis supra subobscuris, subtus prominentibus, lateralibus primariis circiter 25 paribus, a costa subperpendiculare extendentibus, ad marginem evanescentibus, petiolis pubescentibus, circiter 5 mm. longis. Flores axillares, solitarii; pedicellis 6–7 mm. longis, adpresso-pubescentibus; bracteolis 2, alternatis, cito caducis; sepalis 5, imbricatis, subrotundatis, subaequalibus, exteriore adpresso-sericeis, interiore glabris, exterioribus 5–6 mm. longis, 6–7 mm. latis, interioribus leviter latioribus, circiter 6 mm. longis, 8–9 mm. latis, margine scariosis; petalis 5, basi connatis, albidis, late obovatis, circiter 10 mm. longis, 9 mm. latis, apice rotundatis, exteriore omnino adpresso-sericeis; staminibus circiter 45, 4- vel 5-seriatis, linearibus, 6–10 mm. longis, filamentis basi ad corollam adnatis, omnino connatis, 3–6 mm. longis, dense hirsutis, medio accrescentibus, antheris exteriore dense hirsutis, oblongis, circiter 4 mm. longis, ovario subgloboso, sulcato, sericeo, circiter 4 mm. diametro, 4-loculari, multi-ovulato, placentis ramificatis, stylo circiter 5 mm. longo, glabro basi excepto. Fructus non visi.

DISTRIBUTION: British North Borneo.

BRITISH NORTH BORNEO: Tambato, Tambunan, plain, alt. 400 m., *Puasa-Angian* (Brit. North Borneo Forestry Dept. no. 3885) (TYPE, A, K), Feb. 28, 1934 (tree 12 m. high with white flowers).

*Adinandra myrioneura* is outstanding because of the many primary veins on the under surface of the leaf extending nearly at right angles from the midrib, at first very distinct but gradually fading towards the margin until nearly obscure. The bracteoles are alternate and quickly caducous, dropping before anthesis. The corolla-lobes are distinct in that the sericeous pubescence is found over the entire exterior surface rather than confined to a median portion as in the majority of the species in this genus. The stamens are many, the filaments closely joined for their entire length, densely pubescent on the exterior surface, and swollen to the width of the anther at the apex. The four-celled ovary is also an unusual feature. Only three dissections were made, but all showed true 4-celled ovaries, in which the placentae were clearly branched close to the axis. The cell-wall was deeply indented opposite the point of branching.

VERNACULAR NAME: *Bangkau* (Dusun).

56. *Adinandra javanica* Choisy in Zollinger, Syst. Verz. Ind. Archip. 143, 146. 1854; in Mém. Soc. Phys. Hist. Nat. Genève 1: 112 (Mém. Ternstr. 24). 1855. — Miquel, Fl. Ned. Ind. 1 (2): 477. 1859. — Szyszyłowicz in Nat. Pflanzenfam. III. 6: 189. 1893. — Koorders & Valetón, Meded. 'S Lands. Pl. 16: 224 (Bijdr. Boomsoort. Java 3: 224). 1896. — Melchior in Nat. Pflanzenfam. ed. 2, 21: 144. 1925.

DISTRIBUTION: Netherlands East Indies (Java, Lesser Sunda Islands).

JAVA: Besooki, Jang Plateau West, Taman Hidoep., alt. 1900 m., *C. G. G. J. van Steenis* 10806 (A), July 13, 1938. LESSER SUNDA ISLANDS: Sumbawa, *De Voogd* 1643 (A).

Small tree 10–12 m., branching low, near the ground (fide Koorders); branchlets terete, sericeous, becoming glabrous; the terminal buds densely sericeous. Leaves coriaceous, elliptical to obovate 7–10 cm. long, 3.5–5 cm. wide, usually acute at both ends, often obtusely acuminate at the apex, the margin of the upper half serrulate, pubescent when young on lower surface, along the midrib when mature, often glabrous, the petiole semi-terete, 4–5 mm. long, flat on the upper surface, pubescent beneath. Flowers axillary; pedicels up to 2 cm. long, recurved, pubescent, often lightly so and near the calyx-lobes; bracteoles 2, caducous, ovate-lanceolate, 4–5 mm. long when present (fide Koorders), alternate, the lower bracteole as much as 5 mm. below the calyx-lobes; calyx-lobes 5, imbricate, subequal, very obtuse, 8–9 mm. long, densely appressed-sericeous, the narrow margin membranaceous; corolla-lobes not seen, densely sericeous on the outer surface (fide Koorders); stamens (not seen) ca. 40, connate at the base, the filaments glabrous, the anthers sericeous; ovary densely sericeous, somewhat conical, 3-celled, tapering into a densely sericeous style. Mature fruit not seen, immature fruit (ca. 1 cm. diam.) densely sericeous, 3-celled, multi-ovulate, the style densely sericeous, neither style nor fruit showing evidence of glabrescence.

The closest relative to *A. javanica* Choisy is *A. dasyantha* Korthals. Both are characterized by pubescent calyx-lobes, corolla-lobes and ovary. Also both have alternate, deciduous bracteoles. However, *A. javanica* has a densely sericeous style, and the ovary and fruit are distinctly three-celled. On the other hand, *A. dasyantha* differs in the glabrous style, the five-celled ovary and fruit.

In most Malayan and Netherlands East Indian species the presence of a three-celled ovary and fruit presages few ovules and even fewer seeds. *Adinandra javanica* appears to be one of the exceptions. The immature fruit examined shows that the developing seeds are minute and apparently many in number.

57. *Adinandra lutescens* Craib in Kew Bull. Misc. Inform. 1925: 19. 1925; Fl. Siam. Enum. 1: 125. 1925.

DISTRIBUTION: Siam, Federated Malay States (Kedah).

SIAM: Pattani, alt. 50 m., *A. F. G. Kerr* 7828 (TYPE, K), Sept. 12, 1923 (shrub or small tree up to 5 m. high). — Pattani, Banang Sta., evergreen forest, alt. 50 m., *A. F. G. Kerr* 7274 (K), July 22, 1923 (small tree, 8 m. high).

KEDAH: Gunong Jerai, *M. Nur* 9044 (K), Dec. 1925.

Shrub or small tree 5–8 m. high; branches terete, gray-brown, glabrous, the young branchlets appressed-pubescent, the terminal buds fulvous-sericeous. Leaves coriaceous or subcoriaceous, oblong-oblancheolate, 5–11 cm. long, 2.5–4 cm. wide, occasionally asymmetrical, obtusely acuminate

at the apex, cuneate at the base, glabrous, darker above, paler, lightly pubescent beneath, eventually glabrous, the margin lightly denticulate, the veins 10–12 pairs, anastomosing near the margin, the petiole 3–5 mm. long, pubescent beneath, eventually glabrescent. Flowers axillary, solitary; pedicel slender, recurved, 1.5–2.5 cm. long, thickened towards the apex, appressed-pubescent; bracteoles 2, quickly caducous, opposite, immediately below the calyx; calyx-lobes 5, imbricate, ovate, ca. 1 cm. long, 7 mm. wide, unequal, appressed-pubescent, the outer lobes broadly acute, glandular-denticulate along the margin, the inner lobes more nearly rounded, the margin membranaceous, entire; corolla-lobes 5, connate at the base, lanceolate, ca. 1.5 cm. long, 0.5 cm. wide, long-attenuate, tapering into an acuminate apex, sericeous on the median portion of the exterior surface; stamens in series, the filaments ca. 3 mm. long, adnate to the base of the corolla, joined at the base, sericeous on the apical half, the basal half glabrous, the anthers ca. 3 mm. long, densely hirsute, the apicule glabrous, 2–3 mm. long, equalling the anther-cells in length; ovary sericeous, 3-celled, multi-ovulate, tapering into the style, the style entire, sericeous diminishing in density toward the apex. Mature fruit not seen. Immature fruit somewhat globose, densely sericeous, 3-celled.

The outstanding characters of this species are: (1) long-attenuate corolla-lobes, 1.5 cm. long, 0.5 cm. wide, tapering from near the base to an acuminate apex, the sericeous area tapering also; (2) stamens ca. 9 mm. long, with the filament, anther and apicule of about equal length, the apicule unusually long for the genus; (3) bracteoles quickly caducous; and (4) ovary 3-celled, sericeous.

The closest relative is *A. phlebophylla* Hance. In the latter species the corolla-lobes are only 7–9 mm. long and, although they are acute at the apex, they do not taper gradually and continuously from the base to the apex; the stamens measure only 4–5 mm. long; the filaments are glabrous and less than a millimeter in length, the apicule rather inconspicuous; and the veins on the lower surface of the leaves tend to branch midway between the midrib and the margin.

Craib records the ovary as two-celled. Only a single dissection was made in this study on a partially developed fruit. The results showed the young fruit to be clearly three-celled.

VERNACULAR NAME: *Kandis Burong*.

58. *Adinandra oblonga* Craib in Kew Bull. Misc. Inf. 1924: 88. 1924; Fl. Siam. Enum. 1: 125. 1925. — Gagnepain in Fl. Gén. Indo-Chine, Suppl. 1: 284. 1943.

DISTRIBUTION: Siam.

SIAM: Pitsanulok, Sukotai, Kao-luang, open grassy ground, alt. 1100 m., *A. F. G. Kerr* 5923 (TYPE, K), May 2, 1922 (small tree about 4 m. high).

Small tree ca. 4 m. high; young branchlets terete, grayish brown, lightly and finely appressed-pubescent, the terminal bud short, conical, appressed-pubescent. Leaves coriaceous, elliptic to oblong-elliptic, 5–9 cm. long, 2.5–4.5 cm. wide, obtuse or abruptly acuminate at the apex, rounded or cuneate at the base, glabrous above, finely appressed-pubescent beneath, especially along the midrib, the margin lightly revolute when dried, glandular-denticulate, the veins 15–20 pairs, prominent on both surfaces, anastomosing freely, the petiole ca. 5 mm. long, lightly appressed-pubescent.



Flowers axillary, solitary; pedicels ca. 2 cm. long, recurved, lightly appressed-pubescent; bracteoles 2, alternate or subopposite, quickly caducous; calyx-lobes 5, imbricate, 7–8 mm. long, 5–8 mm. wide, finely appressed-pubescent, unequal, the outer lobes smaller, ovate, the inner lobes more obovate, wider; corolla-lobes 5, connate at the base, ovate, acute at the apex, 10–11 mm. long, 5–6 mm. wide, pubescent over the entire exterior surface except along the margin; stamens ca. 35, seriate, 6–7 mm. long, the filaments adnate to the base of the corolla and joined to each other, unequal, 1–2 mm. long, pubescent on the upper third, otherwise glabrous, the anthers ca. 4–5 mm. long, oblong, hirsute, the apicule ca. 1 mm. long, often as long as the shorter filaments; ovary densely appressed-pubescent, tapering into a style densely pubescent at the base, less so near the apex, the stigma 4-parted, oblique. Fruit globose, ca. 1 cm. in diameter, appressed-pubescent, 4-celled, many-seeded.

The distinguishing characters of this species useful in determination are: (1) ovary appressed-pubescent, 4-celled; (2) style densely pubescent at the base, less so towards the apex; (3) stigma 4-parted, oblique; (4) corolla-lobes ca. 1 cm. long, ovate, acute at the apex, pubescent over the entire exterior surface except along the margin; (5) stamens 6–7 mm. long, the filaments very short, 1–2 mm. long; and (6) leaves elliptic, small (up to 8 cm. long), the veins 15–20 pairs, conspicuous on both surfaces.

This species, along with *A. myrioneura* Kob. of Borneo, has a 4-celled ovary. Just how consistent this character may prove to be will depend upon the examination of future collections. In other species, such as *A. Macgregorii* Merrill from the Philippine Islands and *A. Clemensiae* Kob. from British North Borneo, where a 4-celled ovary has been noted, the character was found to be inconsistent. In *A. Clemensiae*, where a 4-celled ovary occurred quite consistently in the type-specimen, more material was available for study, and the prevailing number of cells for the ovary appeared to be five.

In *A. oblonga* the stigma is 4-parted and oblique. In *A. Macgregorii* the style was also 4-parted. Still, on the same specimen were found flowers in which the ovary was 3-celled.

In its gross characters, this species resembles *A. parvifolia* Ridley very closely, the leaves appearing almost identical. However, it can be separated by the longer pedicels, the smaller acute corolla-lobes which are pubescent over the entire external surface, the very short filaments of the stamens, and the 4-celled fruit and 4-parted stigma.

59. *Adinandra coarctata* Craib in Kew Bull. Misc. Inform. 1925: 18. 1925; Fl. Siam. Enum. 1: 124. 1925.

DISTRIBUTION: Siam.

SIAM: Betong, Gunong Ina, evergreen forest, alt. 1200 m., *A. F. G. Kerr 7559* (TYPE, K), Aug. 10, 1923 (small tree ca. 4 m. high).

Small tree ca. 4 m. high; branchlets gray-brown, terete, eventually glabrous, younger branchlets tomentulose, very young branchlets of current year's growth fulvous-pilose, the terminal buds densely fulvous-pilose. Leaves coriaceous, oblong-elliptic, 7–10 cm. long, 3–4 cm. wide, obtusely or abruptly acuminate at the apex, cuneate to somewhat rounded at the

base, glabrous above, lightly pubescent beneath, the pubescence more densely concentrated on the midrib and along the margin, conspicuously dark-dotted beneath, the margin revolute, lightly glandular-apiculate, this condition obscured by the pubescence, the veins 10–12 pairs, conspicuous on both surfaces, anastomosing near the margin, the petiole thick, 5–7 mm. long, densely pubescent on both surfaces. Flowers axillary, solitary; pedicels stout, recurved, ca. 5 mm. long, fulvous-pilose; bracteoles 2, opposite, immediately below the calyx, quickly caducous, when present ovate, ca. 3.5 mm. long, 3 mm. wide, pilose, ciliolate; calyx-lobes 5, imbricate, unequal, the outer lobes broadly ovate, 9–10 mm. long, 8–9 mm. wide, obtuse, pilose, the inner lobes ca. 13 mm. long, pilose, the margins denticulate; the ovary subconical, ca. 4 mm. long, densely sericeous, 5-celled, multi-ovulate, tapering at the apex into a sericeous style glabrous only at the apex.

Craib in his excellent description of *A. coarctata* mentions the ovary as being four-celled. I felt dubious about this character and sacrificed a developing fruit on the type-specimen to verify his finding. My single dissection showed four large well-developed cells with a fifth smaller, almost abortive cell, this latter containing developing ovules, however.

Outstanding characters in this species are: (1) bracteoles quickly caducous, when present ovate, pilose, ciliolate, ca. 3.5 mm. long and 3 mm. wide; (2) inner calyx-lobes larger (ca. 13 mm. long) than the outer lobes, pilose, denticulate along the margin; (3) ovary densely sericeous, 5-celled, with one cell smaller than the others, multi-ovulate; (4) style entire, generally sericeous, glabrous at the apex; (5) terminal buds densely fulvous-pilose; and (6) leaves with a generally thin pubescence on the under surface, the pubescence densely concentrated on the midrib and margin obscuring the glandular-apiculations along the margin.

Although the corolla-lobes and stamens have not been described for this species, from the type and distribution of the pubescence one may expect the former to be pubescent.

This species is so closely associated with *A. glischroloma* Handel-Mazzetti and its varieties of China and Indo-China that later collections may prove it to be no more than another variety in this complex. However, until these further collections are made, it is best to continue the species in its present status.

60. *Adinandra phlebophylla* Hance in Jour. Bot. 14: 240. 1876. — Szyszylowicz in Nat. Pflanzenfam. III. 6: 189. 1893. — Craib, Fl. Siam. Enum. 1: 124. 1925. — Gagnepain in Fl. Gén. Indo-Chine, Suppl. 1: 286. 1943.

*Adinandra integerrima* Pierre, Fl. For. Cochinchine 2: t. 125. 1887. Non T. Anderson. — Pitard in Lecomte, Fl. Gén. Indo-Chine 1: 334. 1910.

*Adinandra integerrima* T. Anderson  $\gamma$  *phlebophylla* (Hance) Pierre, Fl. For. Cochinchine 2: t. 125. 1887.

DISTRIBUTION: Indo-China (Cambodia).

CAMBODIA: Prov. Tpong, Knang Repoeu, alt. 1500 m., *L. Pierre* 608 (ISOTYPES, A, M, NY), May 1870 (tree 8–15 m. high).

Tree 8–15 m. high; branchlets terete, grayish brown, appressed-pubescent when very young, later glabrous, the terminal buds sericeous. Leaves coriaceous, oblong-elliptic, 8–12 cm. long, 3–4 cm. wide, obtusely acuminate

at the apex, acute at the base, glabrous above, sparsely appressed-pubescent beneath, especially along the midrib, the margin serrulate, the veins raised on both surfaces, branching midway between the midrib and the margin, the petiole ca. 5 mm. long, rounded, pubescent beneath, flat, glabrous above. Flowers axillary, solitary; pedicels 2–5 cm. long, slender, graceful, swelling in diameter near the apex, appressed-pubescent at first, later glabrescent; bracteoles 2, caducous, oblong-lanceolate when present, 4 mm. long, 2 mm. wide, densely sericeous, usually close to the calyx; calyx-lobes 5, imbricate, minute at anthesis, unequal, ca. 7–8 mm. long, 5–6 mm. wide, appressed-sericeous, especially the inner lobes, increasing at maturation of fruit to ca. 12 mm. long, 7 mm. wide, ovate, distinctly acute at the apex; corolla-lobes 5, ovate, unequal, 7–9 mm. long, 2–3 mm. wide, densely sericeous, acute at the apex; stamens ca. 30, 2- or 3-seriate, minute, 4–5 mm. long, the filaments only ca. 0.5–0.8 mm. long, joined at the base, glabrous, the anthers oblong, very densely sericeous; ovary and style elongated, only 5 mm. long over all, densely sericeous at anthesis. Fruit globose, ca. 1 cm. diameter, densely sericeous, topped by a persistent sericeous style 1.5 cm. long. Seeds minute, dark brown.

The outstanding characters of this species are: (1) corolla-lobes lightly sericeous, shorter (6–8 mm. long) than the calyx-lobes (7–9 mm. long); (2) stamens minute, ca. 3–4 mm. long, the filaments glabrous, very short (0.5–0.8 mm. long), the anthers so densely sericeous that their outline is difficult to discern; (3) pedicels sturdy, up to 5 cm. long in fruit; (4) bracteoles caducous, when present 4 mm. long; and (5) ovary, fruit and style densely sericeous.

From 1887 to 1925, this species had been considered synonymous with *A. integerrima* T. Anders. Pierre felt the two entities were identical and in his treatment of *A. integerrima* probably used the type of *A. phlebophylla* (Pierre 608) in describing and illustrating *A. integerrima* for his Fl. For. Cochinchine (2: t. 125. 1887). It is safe to assume that this specimen provided the material for both his description and illustrations, since they agree perfectly. Craib (1925), was the first to draw attention again to *A. phlebophylla* and he returned it to its specific status.

*Adinandra phlebophylla* is more closely allied to *A. lutescens* Craib than to *A. integerrima*. In leaf-characters these two species are almost identical. However, Craib's species has a much longer corolla (1.7 cm. long) and the filaments are approximately four times longer and more in proportion with the anthers than those in *A. phlebophylla*.

The number of cells of the ovary is not known. Even though isotypes of the species were available for this study, the material was so poor that I was not able to make dissections which would add to this knowledge.

The species is treated in this portion of the study rather than with the Chinese species since its relationships are with this group and also because of the former confusion of its association with *A. integerrima*.

61. *Adinandra villosa* Choisy in Mém. Soc. Phys. Hist. Nat. Genève 1: 112 (Mém. Ternstr. 24). 1855. — Dyer in Hooker f., Fl. Brit. Ind. 1: 283. 1874. — Kurz, For. Fl. Brit. Burma 1: 100. 1877. — King in Jour. As. Soc. Bengal 59 (2): 190 (Mater. Fl. Malay Penin. 1: 130). 1890. — Szyszylowicz in Nat. Pflanzenfam. III, 6: 189. 1893. — Ridley in Jour. Linn. Soc. Bot. 38: 304. 1908; Fl. Malay



Penin. 1: 196. 1922. — Melchior in Nat. Pflanzenfam. ed. 2, 21: 144. 1925.

*Ternstroemia* ? *sericea* Wallich, Cat. no. 1454.

*Schima Wallichii* Choisy in Mém. Soc. Phys. Hist. Nat. Genève 1: 179 (Mém. Ternstr. 91). 1855.

*Adinandra integerrima* T. Anderson  $\beta$  *villosa* (Choisy) Pierre, Fl. For. Cochinchine 2: t. 125. 1887.

DISTRIBUTION: Malay Peninsula, Burma.

MALAY PENINSULA: Penang, Penang Hill, alt. 670 m., *E. J. H. Corner* 31595 (A, K), July 21, 1936. — Perak, Larut, rocky localities in dense jungle, *Dr. King's Collector* 6256 (K), July 1884 (tree 12–16 m. high; leaves glossy deep green; flowers light greenish white with a silvery gloss; fruit silvery white). — Selangor, Sempang Mines, *H. N. Ridley* 15594 (K), April 1894.

BURMA: Tenasserim, Tavoy, *N. Wallich* 1454 (K).

Tree 12–15 m. high; branchlets pilose, pale brown, the leaf-buds sericeous. Leaves coriaceous, oblong-lanceolate or elliptic, 10–14 cm. long, 3–5 cm. wide, shortly acuminate at the apex, rounded or broadly cuneate at the base, rarely acute, glabrous above, sparsely pubescent beneath, the margin entire or faintly crenulate, the nerves 7–9 pairs, ascending, arching within the margin, not prominent, the petiole ca. 5 mm. long, pilose. Flowers axillary, usually solitary; pedicel pilose ca. 1 cm. long, recurved, pilose; bracteoles 2, caducous, ovate, when present occurring from the middle of the pedicel upward; calyx-lobes 5, imbricate, nearly equal, broadly ovate to somewhat rounded, up to 10 mm. long and 8 mm. wide, pilose on the external surface; corolla-lobes 5, connate at the base, ovate, obtuse or rounded at the apex, densely sericeous on median portion of the external surface, glabrous at the margins; stamens ca. 30, adnate to the base of the corolla, the filaments short, sericeous; ovary depressed-hemispherical, densely sericeous, 5-celled, tapering at the apex into a densely sericeous style. Fruit 10–12 mm. diam., densely sericeous, 5-celled. Seeds numerous, minute, shiny, dark brown, ca. 1.5 mm. long.

This species has been little understood and frequently misinterpreted. My early conclusions were based on a single specimen, *Corner* 31595, in the Arnold Arboretum. However, I found myself unwilling to accept my own interpretation and made a late appeal to Kew for a secondary loan of representative authentic material of this species. To my surprise and satisfaction *Corner* 31595 was included in the loan along with *Wallich* 1454, the latter specimen probably the most renowned in this species.

I was embarrassed when I realized that a psychological element had played an important part in my reluctance to accept the species at first. I mention this unscientific incident, since it may help to explain the dubious position the species has held in the past. Considering some of the very pubescent species such as *A. glischroloma* Handel-Mazzetti, I was very disappointed in the amount of pubescence on *A. villosa* when confronted with the actual type. I had expected a much more pubescent species. Although the name is appropriate, the species is hardly more villous than many other species in the same geographical locality.

All the above cited specimens are in the fruiting stage; hence complete descriptions of corolla-lobes and stamens are still wanting. King in his "Material for a Malayan Flora" gives rather a complete description of the

species and this was used in my own description of corolla-lobes and stamens.

Pierre, in his *Fl. For. Cochinchine* 2: t. 125. 1887, reduced this species to synonymy under *A. integerrima* T. Anders. along with *A. phlebophylla* Hance. Pitard, in *Lecomte, Fl. Gén. Indo-Chine* 1: 334. 1910, followed Pierre in his treatment. However, Craib, *Fl. Siam. Enum.* 1: 125. 1931 retained all as separate entities.

*Adinandra bicuspidata*, sp. nov.

Arbor parva ad 10 m. alta; ramulis teretibus, brunneis, leviter lenticellatis, glabrescentibus, hornotinis pubescentibus adpressis, gemmis dense ferrugineo-sericeis. Folia chartacea, subrotundata vel ovata, 7–12 cm. longa, 3–6 cm. lata, apice abrupte acuminata, basi late cuneata vel cuneata, supra glabra, subtus glabrescentia et leviter punctata, margine integerrima, venis undique prominentibus reticulatisque, primariis 10–12 paribus, intra marginem anastomosantibus arcuantibusque, venis secundariis brevioribus inter primarios frequentibus, petiolis ca. 1 cm. longis, supra planis glabrisque, subtus semi-teretibus, pubescentibus vel glabrescentibus. Flores axillares, solitarii; pedicellis adpresso-pubescentibus, 1–1.5 cm. longis, apice subrecurvatis; bracteolis 2, oppositis, probabiliter post anthesin caducis, ovatis, 6–7 mm. longis, 3–4 mm. latis, sericeis; sepalis 5, imbricatis, inaequalibus, late ovatis, exterioribus ca. 9 mm. longis et 8 mm. latis, apice subapiculatis, dense sericeis, interioribus minoribus; petalis (immaturis) 5, ad basim liberis vel subliberis, oblongo-ovatis, ca. 5 mm. longis et 2.5 mm. latis, dense sericeis margine exceptis; staminibus (immaturis) ca. 35, uniseriatis, ca. 2.5 mm. longis, filamentis ad basim liberis, ca. 0.75 mm. longis, glabris, antheris dense ferrugineo-sericeis, oblongis, apice bicuspidatis, loculis thecarum ultra connectivum projectis; ovario (immaturo) subplano, densissime ferrugineo-sericeo, loculorum numero ignoto, stylo (immaturo) integro, ca. 4 mm. longo, densissime omnino apice incluso ferrugineo-sericeo. Fructus ignotus.

DISTRIBUTION: Malay Peninsula (Penang).

PENANG: Government Hill, alt. 650–700 m., *C. Curtis* 2241 (K, TYPE), March 1890 (small tree 25 ft. high).

Because of the incomplete material in the type specimen I was at first unwilling to describe this new species. However, after careful study it appears to be distinct from the other species in its geographical area. The material, even though incomplete, is sufficient to permit a technical description, and hence I finally have decided to include it in this study.

The name *A. bicuspidata* is derived from the bicuspidate appearance of the anthers. In some species studied, the connective projects beyond the anther cells, causing anthers to appear apiculate. In other species, the anther cells are flush with the connective, causing the anthers to appear truncate. In this new species, the anther cells project sharply above the connective, giving a bicuspidate appearance to the anthers.

Other characteristics which lend distinction to this species are: (1) the chartaceous leaves with the veins distinctly reticulate on both surfaces; and (2) the long ferrugineous pubescence of the anthers, ovary and style. The pubescence of the style is further unusual in that it extends the entire length of the style, obscuring the stigma.

In the type specimen the flowers were immature, and hence the measurements of most floral parts cited above are subject to change when more complete material is available. It appears that this species may be very rare, since it has been collected only once, and that nearly sixty years ago.

Unfortunately, the true number of cells in the ovary could not be ascertained. Although two dissections had been made, in both cases the cell-walls of the ovary were too indistinct to permit one to say with assurance just what their number might be. I am inclined to feel that the ovary is five-celled, but of that I am not certain. Because of the uncertainty of the cell number in the ovary, this species cannot be included in the key and is placed at the end of the Indo-Malaysian species.

At Kew, this species had been associated with *A. villosa* Choisy. However, the chartaceous, reticulate leaves, the bicuspidate anthers, the glabrous filaments and the opposite bracteoles all distinguish *A. bicuspidata* from the older species.

#### LITTLE-KNOWN SPECIES

62. *Adinandra Brefeldii* Koorders in Meded. 'S Lands. Plant. 19: 349, 642. 1898. — Melchior in Nat. Pflanzenfam. ed. 2, 21: 144. 1925.

DISTRIBUTION: Netherlands East Indies (Celebes).

CELEBES: [Cited here dubiously] En Ond. Makale-Rantepao, Paniki, alt. 300 m., *Neth. Ind. For. Serv. b.b.* 20271 (A), Feb. 12, 1938.

Tree 43 m. high, the trunk 105 cm. in diameter, the bark brown-gray. Leaves elliptic-oblong, decurrent at the base into a petiole 2 cm. long, the lower  $\frac{1}{5}$  of the margin entire, the remainder crenate-serrate, acute at the apex, glabrous on both surfaces, ca. 14 cm. long, 6 cm. wide (the leaves of the young shoots 30 cm. long and 11.5 cm. wide). Young parts minute appressed-puberulent. Branchlets glabrous. Peduncles 2.5–3.5 cm. long, glabrous, bibracteolate. Sepals glabrous, the margin subciliate, semi-orbicular, 5 mm. long. Fruit depressed-globose, 2.5 cm. diam. glabrous.

*Adinandra Brefeldii* and the following species, *A. celebica*, were offered by Koorders as new species with accompanying descriptions far too brief for satisfactory study without type-specimens. It may be that the types were also incomplete. Although both species appear to have been described from fruiting material, very little information concerning the fruit is presented.

The interesting feature in the above description (which is merely a translation of the original), is the petiole of the leaf. Koorders mentions the leaf as being decurrent into the petiole 2 cm. long. In the above-cited sterile specimen, the petiole is hardly much over 1 cm. long but the leaf-blade is decurrent into the petiole and this decurrent condition persists along the branchlet. The specimen, although sterile, evidently has been collected from a vigorous young shoot, the leaves being of considerable size.

63. *Adinandra celebica* Koorders in Meded. 'S Lands Plant. 19: 350, 642. 1898. — Melchior in Nat. Pflanzenfam. ed. 2, 21: 144. 1925.

DISTRIBUTION: Netherlands East Indies (Celebes).

CELEBES: Kandari, *O. Beccari s. n.* (K), Feb. 1883.



Tree up to 25 m. high, the trunk 45 cm. in diameter; branches and branchlets terete, glabrous, gray-brown, the terminal buds appressed-pubescent. Leaves coriaceous or subcoriaceous, obovate to obovate-elliptic, 10–12 cm. long, 3–5 cm. wide, occasionally considerably smaller, obtuse at the apex, cuneate at the base, glabrous on both surfaces, punctate-dotted beneath, the margin lightly denticulate to entire, the veins 10–12 pairs, arching upward and anastomosing near the margin, rather inconspicuous, the petiole ca. 5 mm. long, glabrous, occasionally lightly appressed-pubescent (on newly unfolded leaves). Fruit axillary, solitary; pedicel 2–2.5 cm. long (3–4 cm., Koorders), glabrous, terete, recurved near the apex; bracteoles 2, persistent, alternate below the calyx, glabrous, almost vestigial, scale-like, subdeltoid, ca. 1.5 mm. long; calyx-lobes 5, imbricate, quite glabrous, subrotund, ca. 5–6 mm. long, 6–7 mm. wide, rugulose. Young fruit glabrous, subglobose, tapering at the apex into a glabrous, entire style, 5-celled, many developing seeds.

The information offered by Koorders in his description of this species is too brief, and offers no details that might not be applied to any but the most exceptional species in the genus. He does state, however, that in the Kew Herbarium there is a specimen collected by Beccari in central Celebes which is supposedly identical with his type. From the Kew Herbarium was obtained a specimen collected by Beccari which may or may not be the specimen in question; hence it is cited here dubiously. The pedicels in the Beccari specimen measure not more than 2.5 cm., whereas Koorders records the measurements as 3–4 cm. He also states that the leaves are glabrous to the naked eye but laxly pilose under the hand-lens. The Beccari specimen is quite glabrous. However, the terminal leaf-buds are appressed-pubescent which would indicate that the very young leaves are pubescent, on the under surface at least. Only by an examination of the actual type can one expect to gain a concept of this species.

64. *Adinandra crenulata* T. Anderson ex Dyer in Hooker f., Fl. Brit. Ind. 1: 283. 1874. — Szyszyłowicz in Nat. Pflanzenfam. III. 6: 189. 1893. — Melchior in op. cit., ed. 2, 21: 144. 1925.

*Ternstroemia crenulata* Wallich, Cat. no. 3723, herb. Madras.

A discussion of this species is quite difficult since the only available reference is the sketchy original description by T. Anderson. A note, perhaps the original manuscript of Anderson, on an otherwise blank herbarium sheet in Kew states, "Possibly a native of the Malayan peninsula. Wallich's specimen is the only one that exists and was obtained from the Madras Herbarium and bears no locality. It is probably one of those plants collected by König during his visit to the settlements in the Malayan peninsula." Considerable doubt as to the origin of the type existed at the time of the description, and, from the literature examined, it appears that no worker has associated any material collected later with the species *A. crenulata*.

Both Szyszyłowicz and Melchior in their treatments of the Theaceae in "Die Natürliche Pflanzenfamilien" incorporated this species in their work.

Unfortunately, the original description of the species is such that it

might be applied to any number of species in the Malayan region. Because of this lack of a single distinctive feature, and the fact that the type is in Madras rather than in one of the Malayan herbaria, its true identity has been lost and will continue to be until opportunity can be afforded some worker to study the type.

*Ridley 4801*, deposited in the U. S. National Herbarium and collected in the Singapore Garden Jungle, may belong to this species. The distinguishing feature of this specimen is the decided crenulation of the leaf-margin. It is not a good specimen. There are no terminal buds and the partially developed fruits are in rather poor condition. It was originally identified as *A. maculosa* T. Anders.

#### DOUBTFUL SPECIES

65. *Adinandra cordata* Choisy in Mém. Soc. Phys. Hist. Nat. Genève 1: 112 (Mém. Ternstr. 24). 1855.

This species, mentioned only once and then doubtfully by Choisy, is based upon a reported species by Gaudichaud from the Hawaiian Islands. There has been no other record of *Adinandra* from the Hawaiian Islands since that time, hence one is led to believe that Choisy erred in his generic designation. The subsessile cordate leaves lead one to believe that Choisy may have had in mind *Eurya sandwicensis* A. Gray. This is merely a supposition, since no material has been available for this study. However, Choisy's brief description does apply for the most part to specimens examined of *E. sandwicensis*.

66. *Adinandra sylvestris* Jack in Malay Misc. 2 (7): 3. 1822 [repr. in Calcutta Jour. Nat. Hist. 4: 208. 1843; et in Miscel. Papers Indo-China II. 2: 295, 302. 1887].

The knowledge of this species is very limited. In Misc. Papers Indo-China is reproduced the original description. There, on p. 295, *Adinandra sylvestris* is described as "Bacca trilocularibus. Suka beranak. Malay. A large forest tree at Moco Moco." On p. 302 of the same volume, Sir J. D. Hooker, in a note to the editor states, "*Adinandra sylvestris*. *Not taken up by later authors*.—Sûka bĕrĕnak—i. e., fond of having children."

#### EXCLUDED SPECIES

- Adinandra Miquelii* King in Jour. As. Soc. Bengal 59 (2): 192 (Mater. Fl. Malay Penin. 1: 132). 1890=*Ternstroemia bancana* Miquel, Fl. Ned. Ind. Suppl. 1: 477. 1862.

- Adinandra bancana* (Miquel) King ex Durand & Jackson, Index Kew. Suppl. 1 (Add. & Emend. II): 401. 1906=*Ternstroemia bancana* Miquel, Fl. Ned. Ind. Suppl. 1: 477. 1862.

This species was originally described as *Ternstroemia bancana* by Miquel in 1862. In 1890, King, thinking the species an *Adinandra*, transferred it to the latter genus under the name *A. Miquelii*. Later, Ridley (Fl. Malay Penin. 1: 197. 1922) treated the species under its original genus and name, *Ternstroemia bancana* Miquel. In the meantime, Durand and

Jackson (1906) had made still another combination, *Adinandra bancana*, erroneously attributing the binomial to King.

#### AFRICAN SPECIES

Two species of *Adinandra* have been described from Africa. The first species, *A. Mannii* Oliver (1868), was collected on St. Thomas Island off the west coast of Africa in the Bay of Guinea, and the second species, *A. Schliebenii* Melchior (1934), was collected in Tanganyika Territory in eastern Africa, a span of nearly the whole African continent separating the two entities. It appears from the literature that both species have been collected only once. Although these two species differ considerably in many features from the Indo-Malaysian and Papuan groups, on the other hand they possess many interesting characteristics in common with the latter and are closely related. Among the outstanding characters in which they differ from the other groups are: (1) stamens in a single series, the filaments glabrous, free except at the very base, the anthers glabrous, subsagittate; and (2) corolla-lobes three times longer (35–50 mm.) than the calyx-lobes, connate at the base only, otherwise free, disposed in a pseudo-tube, the apices of the lobes arching over the pistil and stamens.

Szyszyłowicz (1893) created a section, Eleutherandra, for *A. Mannii* based on the free filaments and supposedly separating this species from all other species of *Adinandra*. Melchior (1925) continued this section of Szyszyłowicz and in 1934 added to the section the species *A. Schliebenii*. This character, if meant to separate these two species from all others, is not well chosen, since nearly every species in China must be included. The most outstanding characters to my mind are the glabrous subsagittate anthers and the corolla-lobes arranged in a tube.

No formal key is necessary to separate here these two species. Their differences are mentioned in detail in the discussion following the description.

67. *Adinandra Mannii* Oliver in Fl. Trop. Afr. 1: 170. 1868. — Hooker, Icon. Pl. 11: 29, t. 1039. 1867. — Szyszyłowicz in Nat. Pflanzenfam. III. 6: 189. 1893. — Melchior in Notizbl. Bot. Gart. Mus. Berlin 8: 657. 1924; 11: 1100. 1934; in Nat. Pflanzenfam. ed. 2, 21: 144. 1925.

DISTRIBUTION: West Africa (Island of St. Thomas).

GULF OF GUINEA: Island of St. Thomas, summit of the peak of the island, *G. Mann 1066* (ISOTYPE, G).

Tree 10 m. high; branches gray, terete, glabrous, the young branchlets red-brown, glabrous, terete, minutely tuberculate-punctate, the terminal buds glabrous. Leaves chartaceous to subcoriaceous, oblong-elliptic to oblong-obovate, quite uniform in size, 6–7 (–9) cm. long, 2–3 cm. wide, acuminate at the apex, asymmetrical, subrotund at the base, glabrous on both surfaces, the midrib reddish near the base, tuberculate-punctate on the lower surface, the margin glandular-denticulate, the veins 15–18 pairs, conspicuous but not prominent, anastomosing midway to the margin, the petiole 1–2 mm. long. Flowers axillary, ? solitary; pedicel ca. 2 cm. long



(fide Oliver), glabrous; bracteoles 2, persistent, glabrous, opposite, immediately below the calyx, broadly ovate, 7–8 mm. long, 5–6 mm. wide, acute at the apex, carinate; calyx-lobes 5, imbricate, glabrous on the exterior surface, very lightly appressed-pubescent (with binocular) on the interior surface, broadly ovate, acute at the apex, unequal, the two outer lobes 12–14 mm. long, ca. 10 mm. wide, the three inner lobes 17–19 mm. long, ca. 10 mm. wide, their inner margins scarious, entire; corolla-lobes 5, slightly connate only at the very base, not spreading, somewhat tubuliform, oblong, ca. 25 (35–45) mm. long, 7–10 mm. wide, obtuse to subrotund at the apex; stamens ca. 30 in a single series, equal, ca. 8 mm. long, the filaments glabrous, ca. 4 mm. long, adnate to the base of the corolla, otherwise free, the anthers oblong-linear, equalling the filaments in length, strictly glabrous, the apicule less than 0.5 mm. long, truncate to emarginate; ovary conical-ovoid, glabrous, ca. 4 mm. diam., tapering into the style, 4-celled, multi-ovulate, the placentae bifid, the style glabrous, entire, ca. 22 mm. long, the stigma 4-lobed. Fruit not seen.

The outstanding characters which separate this and the following species, *A. Schliebenii* Melchior, from the rest of the genus are: (1) anthers glabrous; (2) filaments glabrous, free their entire length except at the very base, at which point they are joined together as well as adnate to the base of the corolla; and (3) corolla-lobes linear-oblong, connate at the base only, but connivent their entire length presenting a tube-like appearance.

The characters which separate *A. Mannii* from *A. Schliebenii* are: (1) inner calyx-lobes glabrous and entire; (2) corolla-lobes subrotund at the apex; (3) bracteoles longer, measuring 7–8 mm. in length; (4) ovary and style glabrous; and (5) stamens only about half as long (8 mm.) and more numerous (30).

68. *Adinandra Schliebenii* Melchior in Notizbl. Bot. Gart. Mus. Berlin 11: 1076, 1097. 1934.

DISTRIBUTION: East Africa (Tanganyika Territory).

NO SPECIMEN SEEN.

Tree 20–30 m. high; very young branchlets smooth, compressed, glabrous, red to gray-brown. Leaves chartaceous to coriaceous, obovate-oblong, 5–10 cm. long, 2–3.5 cm. wide, acute at the apex or shortly and obtusely acuminate, cuneate at the base, glabrous on both surfaces, the midrib red beneath, the margin serrulate-dentate, glandular, the veins conspicuous beneath because of the red color, the petiole ca. 5 mm. long. Flowers axillary, solitary, ca. 3 cm. long; pedicels 2.5–3.5 cm. long, recurved, glabrous; bracteoles 2, persistent, opposite, immediately below the calyx, glabrous, broadly ovate, acute at the apex, carinate, the outer 3 mm. long and wide, the inner 5 mm. long and wide; calyx-lobes 5, imbricate, ovate, acute at the apex, unequal, varying in length from 10 mm. (outer lobe) to 17 mm. (inner lobe), ca. 12 mm. wide, the two outer lobes glabrous on the exterior surface, the three inner lobes sericeous on the exterior surface except along the scarious margins, ciliolate; corolla-lobes 5, free, twice as long as the innermost calyx-lobe, linear-oblong, 32–45 mm. long, 5–7 mm. wide, acute at the apex, somewhat narrowed and connate at the base, not spreading, somewhat tubuliform; stamens 15–20, uni-seriate, ca. 15 mm. long, glabrous, the filaments free (inter se), adnate

to the base of the corolla, filiform, 8–9 mm. long, the anthers linear, ca. 5 mm. long, cordate-sagittate at the base, the connective projected at the apex into a small subulate-lanceolate apicule 1 mm. long; ovary conical, ca. 6 mm. long, 4 mm. wide, sericeous-tomentose, imperfectly 5-celled, multi-ovulate, attenuate at the apex into a filiform style 24–30 mm. long, sericeous along the lower portion, glabrous along the upper portion, lightly 5-sulcate, the stigma minute, lightly 5-sulcate. Fruit indehiscent, conical-ovoid, ca. 2 cm. long, 1 cm. wide, the seeds many, small, reniform, 1.2–1.5 mm. diam., brown, shining, reticulate.

This species has been described so minutely that it can be separated easily from the preceding species, even though the type has not been seen. It is fortunate, since the type may not be in existence any longer.

*Adinandra Schliebenii* Melchior was collected by H. J. Schlieben in Tanganyika Territory in eastern Africa, far removed from the Island of St. Thomas in the Bay of Guinea where *A. Mannii* was collected.

According to Melchior, the type specimen is numbered 3175 and was found growing on the northwest side of the Uluguru Forest in Morogoro (Tanganyika Terr.), at an altitude of 1900 m. The flowers are orange and red in color. On December 28, 1932, the plant was in both flower and fruit.

The characters separating this species from *A. Mannii* are: (1) inner calyx-lobes pubescent and ciliolate; (2) corolla-lobes acute at the apex; (3) bracteoles unequal and shorter, measuring 3 and 5 mm. in length; (4) ovary and lower half of the style sericeous; and (5) stamens twice as long, measuring 15 mm. in length, and less in number (15–20).

VERNACULAR NAME: *Msungu* (Kiliguru).

#### PAPUASIAN SPECIES

To date, three species have been described from New Guinea. *A. Forbesii* Baker, *A. Brassii* Kobuski, and *A. calosericea* Diels. The last named species has been transferred to the new genus *Archboldiodendron*, which is midway between *Gordonia* and *Adinandra* in characters. The styles in *Archboldiodendron* are free, very short, and recurved, resembling those of *Gordonia*. In wood-structure the genus resembles *Adinandra*. It is not known as yet whether the fruit is dehiscent or indehiscent. From the appearance of the ovules one would not expect the seeds to be winged.

The first two species mentioned above belong, according to the collector, L. J. Brass, among the very large trees of New Guinea. They are closely related to each other and are separated from the Indo-Malaysian species by their large, fleshy purple corolla-lobes and their very numerous (50–60), long, densely pubescent stamens, in very definite series. The characteristics separating the two species from each other are noted in the discussions following their descriptions.

69. *Adinandra Forbesii* Baker f. in Jour. Bot. 61: Suppl. 4. 1923. — Kobuski in Jour. Arnold Arb. 21: 152. 1940.

DISTRIBUTION: British New Guinea.

BRITISH NEW GUINEA: Sogeri region, Mt. Gawada, *H. O. Forbes 545* (TYPE, Brit. Mus. Nat. Hist.; ISOTYPE, K), 1885–1886.

Large tree; branchlets gray, terete, glabrous, the terminal buds appressed-pubescent. Leaves coriaceous, ovate-oblong, 5–8 cm. long, 2.8–3.5 cm. wide, acute or broadly acute at the apex, cuneate at the base, glabrous on both surfaces, the margin flat, lightly serrulate, the veins 8–10 pairs, conspicuous on the lower surface, less so on the upper surface, anastomosing and arching upward near the margin, the reticulations quite conspicuous, the petiole up to 10 mm. long, glabrous. Flowers axillary, solitary; pedicel up to 4.5 cm. long, glabrous, conspicuously lenticellate; bracteoles 2, persistent, opposite, immediately below the calyx, broadly ovate or deltoid, ca. 1.5 mm. long, lightly appressed-pubescent; calyx-lobes 5, imbricate, recurved even in the bud, semi-orbicular, ca. 5 mm. long and wide, lightly appressed-pubescent or glabrescent; corolla-lobes 5, connate at the base, fleshy, glabrous, 15–20 mm. long, 12–14 mm. wide, scarious at the margin; stamens ca. 56, 5-seriate, 10–14 mm. long, filaments only lightly adnate to the base of the corolla, connate, densely sericeous on the exterior surface, and the upper half of the interior surface, the anthers lightly hirsute, oblong, subequal, 4–5 mm. long; ovary globose, glabrous, ca. 5 mm. long, 6 mm. wide, attenuate at the apex into an entire style, 5-celled, multi-ovulate. Fruit not seen.

*Adinandra Forbesii* can be separated from *A. Brassii* by the following characters: (1) leaves oblong-elliptic, acute at both ends, conspicuously veined on the under surface; (2) pedicels up to 4.5 cm. long, glabrous, covered with many conspicuous lenticels; (3) bracteoles opposite; (4) corolla-lobes glabrous; and (5) calyx-lobes recurved, even in the bud.

This species is closely related to *A. Brassii* and has many characteristics in common with it, especially in the floral parts. In both species the corolla-lobes are fleshy, the calyx-lobes hardly more than 5 mm. long and thinner than the corolla-lobes, the stamens are conspicuously 5-seriate, long (up to 15 mm.), and densely sericeous.

According to Baker, Szyszylowicz, and later, Melchior, the stamens are described as "pentadelphous" or in "five-bundles." True, they vary in length according to the series but are not distinctly in bundle formation. They appear joined in a single tube. Perhaps, in drying or in boiling they may be broken up into groups, but my study showed them more characteristically in an unbroken tube-formation.

70. *Adinandra Brassii* Kobuski in Jour. Arnold Arb. 21: 150. 1940.

DISTRIBUTION: New Guinea.

BRITISH NEW GUINEA: Lake Daviumbu, Middle Fly River, rain-forest, *L. J. Brass* 7856 (TYPE, A), Sept. 1936 (very large tree with thick scaly bark; flowers purple).—Wuroi, Oriomo River, Western Division, riverine rain-forest, alt. 5–10 m., *L. J. Brass* 5874 (A, NY), Feb. 2, 1934 (large heavy-boled, spreading tree with flaky-scaly brown bark and tough brown wood; leaf apex subretuse and margin much recurved, especially near the base; flowers purple, pendent beneath leaves). NETHERLANDS NEW GUINEA: Two kilometers s. w. of Bernhard Camp, Idenburg River, frequent on slopes of primary rain forest, alt. 850 m., *L. J. Brass & C. Versteegh* 13176 (A), March 19, 1939 (tree 29 m. high, diam. 43 cm., the crown not wide-spreading, the bark 13 mm. thick, black, scaly, fairly rough, the sap-wood red-brown, the heart-wood violet).—Six kilometers s. w. of Bernhard Camp, Idenburg River, frequent tree of primary forest, on slope of ridge, alt. 1200 m., *L. J. Brass & C. Versteegh* 12519 (A), Feb. 15, 1939 (tree 28 m. high, diameter 55 cm., crown not wide-spreading, the bark 8 mm.



thick, brown fairly smooth, the sap-wood light brown, the heart-wood violet; flowers dark red; fruit green when young, red when mature).

Very large trees up to 30 m. high; branchlets gray, terete, glabrous, appressed-pubescent at the very tip, the terminal bud appressed-pubescent. Leaves thick-coriaceous, obovate to subrotund, (4-) 7-11 cm. long, (2.5-) 4-6 cm. wide, subrotund and subemarginate at the apex, cuneate to rounded at the base, the upper surface glabrous, shining, the lower surface glabrescent, the margin subrevolute with a few inconspicuous glands, the veins 15-20 pairs, inconspicuous on the lower surface, the petiole glabrous, 5-7 mm. long. Flowers axillary, solitary or in pairs; pedicel appressed-pubescent or glabrescent, free from lenticels, 3-3.5 cm. long; bracteoles 2, persistent, below the calyx, subopposite or alternate, broadly deltoid, ca. 1.5 mm. long, 2.5 mm. wide, puberulent; calyx-lobes 5, imbricate, broadly ovate to subrotund, 4-5 mm. long, 5-6 mm. wide, obtuse or rounded at the apex, lightly appressed-pubescent; corolla-lobes 5, lightly connate at the base, purple, fleshy, 15-20 mm. long, 14-16 mm. wide, appressed-pubescent on the external surface, scarious at the margin; stamens 55-60, 5-seriate, 10-15 mm. long; filaments only lightly adnate to the base of the corolla, 6-11 mm. long, connate, densely sericeous on the exterior surface, the anthers hirsute, oblong, subequal, 3-4 mm. long; ovary globose, glabrous, ca. 6 mm. long, 7 mm. wide, gradually attenuate into the entire style, 5-celled, the placentae prominently 2-branched, recurved with many ovules attached. Fruit globose, red, glabrous, up to 3 cm. long.

*Adinandra Brassii* is listed by Brass as one of the large trees of New Guinea. It is a very distinctive species characterized by thick, dark, scaly bark, light brown or red-brown sap-wood and purple heart-wood. The corolla-lobes are purple, and much more fleshy than the Malayan and Chinese species; the calyx-lobes, on the other hand, are smaller and thinner.

*Adinandra Brassii* can be separated from *A. Forbesii*, its closest relative and the only other species known at present from New Guinea, by its obovate or subrotund leaves which are not oblong, the much less conspicuous veining, and the fine appressed-pubescent corolla-lobes.

When first described this species appeared very outstanding because of the densely hirsute anthers and filaments. Since Baker, in describing *A. Forbesii*, did not mention pubescence on either the corolla-lobes or the stamens, I assumed them both to be glabrous. An examination of the type of *A. Forbesii* showed, as far as the corolla-lobes were concerned, this assumption to be correct. However, the stamens (both anthers and filaments) are so densely sericeous that they appear to be the most noticeable characteristic of the flower.

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## THE CYPERACEAE COLLECTED IN NEW GUINEA

BY L. J. BRASS, I\*

S. T. BLAKE

*With four text-figures*

THIS is the first contribution to an account of the specimens of Cyperaceae collected in New Guinea chiefly by Mr. L. J. Brass during the Archbold Expeditions between 1933 and 1939. Included also in the treatment are some other specimens from New Guinea and the Solomon Islands from various collections. I am particularly grateful to Prof. Elmer D. Merrill, of the Arnold Arboretum, for the opportunity to study the Brass collection, and to Dr. Lily M. Perry for copies of much literature unavailable to me. To Mr. A. J. Jessep and Mr. J. H. Willis I am indebted for the loan of specimens and literature from the National Herbarium of Victoria, Melbourne (cited as herb. Melbourne), and to Mr. W. Hartley for the loan of a set of the specimens collected by Mr. C. E. Carr, now in the herbarium of the Council for Scientific and Industrial Research, Canberra (cited as herb. Canberra).

Unless otherwise indicated, the type-specimens of new species are in the Queensland Herbarium, Brisbane (herb. Brisbane) and duplicate-types in the Gray Herbarium of Harvard University, Cambridge, Mass.

The present paper deals with the genus *Carex*, and in this genus I have received valuable help from Mr. E. Nemes, of the Herbarium, Royal Botanic Gardens, Kew, England, who has been studying the Malaysian and Australasian species of the genus for some years. The arrangement of species here follows that in Kükenthal's well-known monograph in *Das Pflanzenreich* IV.20. 1909, but some variations of his treatment have been found necessary at this later date. The specimens have been critically compared with copious Australian material, but the comparison with Malaysian material has been much less extensive and considerable reliance has had to be placed on descriptions alone.

*Carex* L.Subgen. *Primocarex* Kükenth.

*Carex eremostachya* sp. nov. (Sect. *Circinatae* Meinsh. sensu Kükenth.). FIG. 1, A.

Rhizoma repens circiter 1.5 mm. crassum squamis tenuibus brunneis opacis tenuiter striatis obtectum. Culmi approximati vel laxe caespitosi,

\* Botanical Results of the Richard Archbold Expeditions.

circiter 20–25 cm. alti, graciles flaccidulique, acute triquetri admodum compressi, scabri. Folia pauca culmum superantia, inferiora ad vaginas brunneas integras redacta, 3–4 superiora laminifera; laminae acutae, usque ad 20 cm. longae, 2–2.5 mm. latae, planae, glabrae, inferne laeves sursum nervis marginibusque scabrae, carinatae ceterum obscure nervosae. Spica unica, erecta, androgynaecea, ebracteata, 10–12 mm. longa, 5 mm. crassa, oblonga, pluri- et densiflora, variegata, pars mascula linearis circiter 4–5 mm. longa. Glumae femineae ovatae acute acuminatae, 3.5–4 mm. longae, glabrae, dorso obtuse carinato 3-nerves, lateribus rubro-brunneae. Utriculi suberecti, 4.5 mm. longi, 1.2 mm. lati, membranacei, pallide viridescetes, elliptici, rostrati, acutiuscule triquetri, glabri laevesque, prominule circiter 15-nerves, basin versus angustati brevissime stipitati, sursum in rostrum circiter 1.5 mm. longum gracile lineare triquetrum glabrum laeve ore firmo bidentatum (dentibus strictis acutis) subsensim contracti. Nux utriculo

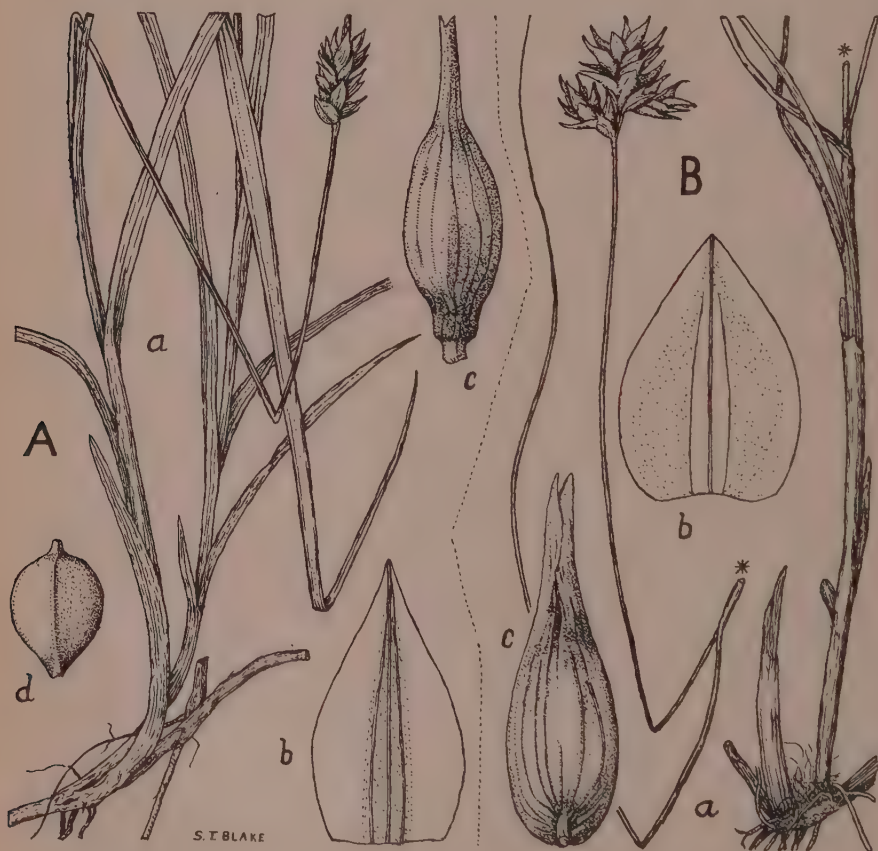


FIG. 1. A. *Carex eremostachya* S. T. Blake: a. part of plant with fruiting culm,  $\times 1$ ; b. pistillate glume, flattened out,  $\times 10$ ; c. utricle, dorsal view,  $\times 10$ ; d. nut,  $\times 10$ . B. *Carex perileia* S. T. Blake: a. part of plant with fruiting culm,  $\times 1$ ; b. pistillate glume, flattened out,  $\times 10$ ; c. utricle, dorsal view,  $\times 10$ . All figures from type-specimens.



brevior et subaequilata, 1.8 mm. longa, 1.2 mm. lata, oblonga subobovoidea, obtusissima sed brevissime acuminato-apiculata, basi subacuta, valde triquetra angulis prominulis, lateribus fere plana. Stylus basi haud in-crassatus; stigmata 3.

NETHERLANDS NEW GUINEA: 9 km. northeast of Lake Habbema, *Brass 10255* (TYPE), October 1938, alt. 2800 m., massed on open beaches of small stream in forest.

This species is most nearly allied to *C. rhizopoda* Maxim., from Japan, differing in the more densely-flowered female part of the spike with broader reddish brown (not green) glumes, the nut more obtuse at each end, and perhaps also in the shorter male part of the spike. Ohwi, in Mem. Coll. Sci. Kyoto Imper. Univ. ser. B, 11(5): 443. 1936, has erected a new section *Rhizopodae* Ohwi for *C. rhizopoda*, but *C. eremostachya* appears to agree better with the characters of the *Circinatae*, under which Kükenthal arranged *C. rhizopoda* in Pflanzenr. IV.20: 98. 1909. *C. eremostachya* also appears to be closely allied to *C. Petelotii* Gross, but to judge from the description the latter has a narrower spike but longer utricles (5-6 mm.). No mention is made of a rhizome.

*Carex capillacea* Boott, Illustr. 1: 44, t. 110. 1858.

*Carex rara* Boott subsp. *capillacea* (Boott) Kükenth. in Pflanzenr. IV.20: 102. 1909.

NETHERLANDS NEW GUINEA: Lake Habbema, *Brass 9085*, August 1938, alt. 3225 m., scattered along grassy shores of lake; 11 km. northeast of top of Mt. Wilhelmina, *Brass & Myer-Drees 9751*, Sept. 1938, alt. 3400 m., in wet grassy valley.

Not previously recorded from New Guinea; known to extend as far north as Sakhalin and Manchuria and west to Sikkim, and known to occur in southeastern Australia. *Brass 9085* has a short setaceous bract half as long as the spike.

#### Subgen. *Vignea* (Beauv.) Nees

*Carex appressa* R. Br. Prodr. 242. 1810; Kükenth. in Bot. Jahrb. 69: 261. 1938; Ohwi in Bot. Mag. Tokyo 56: 214. 1942.

NETHERLANDS NEW GUINEA: Lake Habbema, *Brass 9248*, August 1938, alt. 3225 m., gregarious on wet low shores of lake, erect in clumps to 1.5 m. high.

Previously recorded for Netherlands New Guinea by Ohwi, l. c., and for Northeast New Guinea by Kükenthal, l. c.; elsewhere known from Australia, New Zealand and its dependencies, and New Caledonia.

*Carex curta* Gooden. in Trans. Linn. Soc. Lond. 2: 145. 1794.

NETHERLANDS NEW GUINEA: Lake Habbema, *Brass 9037*, August 1938, alt. 3225 m., common on marshy flats; Lake Habbema, *Brass 9119*, August 1938, alt. 3225 m., moist burnt-over ground in a native camp; Lake Habbema, *Brass 9539*, August 1938, alt. 3225 m., open grassland, plentiful on wet sandy soil.

Not previously recorded for New Guinea, but widely spread in Europe, Asia, North and South America, and southeastern Australia.

This species has commonly been called *C. canescens* L., but E. S. Marshall has shown, in Jour. Bot. 45: 365. 1907, that the type of Linnaeus is a specimen of quite a different plant, commonly known as *C. Buxbaumii* Wahlenb., and that the present plant has to be called *C. curta* Gooden. This view is followed by Nelves in Proc. Linn. Soc. Lond. 155 sess.: 284.

1944. The confusion seems to have arisen with the misidentification by Lightfoot, Fl. Scotica 550. 1777, and has been perpetuated by such authorities as Bentham (e.g. in Handb. Brit. Fl. 2: 913. 1865, and in Fl. Austral. 7: 439. 1878), Boeckeler (in Linnaea 39: 122. 1875), C. B. Clarke (in Hook. f. Fl. Brit. Ind. 6: 706. 1894), Kükenthal (in Pflanzenr. IV.20: 216. 1909), Ohwi (in Mem. Coll. Sci. Kyoto Imper. Univ. ser. B, 11(5): 268. 1936), Mackenzie (in N. Am. Fl. 18: 374. 1935), and Duman (in Catholic Univ. Am. Biol. Ser. 36: 44. 1941). F. N. Williams, when discussing the European varieties of *Carex canescens* in Jour. Bot. 46: 369–376. 1909, agreed with Marshall's interpretation, but continued to use the name *C. canescens* in the traditional sense with the remark that "I think that all doubt is cleared away by citing Lightfoot as the authority." But this practice is contrary to the International Rules of Nomenclature, particularly Arts. 16, 18, 46 and 47.

*Carex perileia* sp. nov. (Sect. *Elongatae* Kunth). FIG. 1, B.

Rhizoma stoloniforme tenue. Culmi caespitosi, gracillimi, compressi trigoni, striati, glabri, laeves, usque ad medium foliati, quoad visi 20 cm. alti. Folia pauca culmum superantia, flexuosa, angustissima, conduplicata (explanata circiter 1 mm. lata), marginibus superioribus scaberula, ima ad vaginas persistentes pallidas redacta. Inflorescentia subcapitata, ovata, densa, brunnea, circa 1.5 cm. longa lataque; bracteae squamiformes, ima breviter aristata. Spicae 3 (quoad visae) approximatae, sessiles, gynaeandroe parte masculina perbrevis, obovatae vel oblongae, squarrosae, 7–10 mm. longae, 7–8 mm. latae. Glumae femineae ovatae, acutae, muticae vel fere muticae, carina angusta 1–3-nervi virides, lateribus nervibus brunneae vel rufo-brunneae nitidae, marginibus anguste albae subscariosae, 3–3.5 mm. longae. Utriculi patuli, 5 mm. longi, 1.4 mm. lati, fulvescentes viridi-marginati, omnino glabri laevesque, epunctulati, elliptici, membranacei, basi rotundata incrassati, plano-(subconcavo-) convexi, nervis 2 marginalibus conspicuis, nervis tenuioribus latere plano circiter 7 latere convexo circiter 10 notati, sursum in rostrum latiusculum complanatum leviter incurvum breviter bidentatum omnino laeve glabrumque purpureo-tinctum cetero utriculo subaequilongum dorso anguste sulcato profunde fissum subsensim contracti. Nux utriculum implens, 2 mm. longa, 1.2 mm. lata, oblongo-ovata, plano-convexa. Stigmata 2.

NETHERLANDS NEW GUINEA: Lake Habbema, *Brass* 9583 (TYPE), August 1938, alt. 3225 m., marshy shores of lake.

The specimen seen has a single fruiting culm. The species is very close to some forms of *C. echinata* Murr. (*C. stellulata* Good.), but has narrower leaves and longer utricles with a relatively longer beak deeply split on the back and with entirely smooth margins. The split on the back usually appears as a narrow brown furrow, as the result of the overlapping of the edges.

#### Subgen. *Indocarex* Baill.

*Carex Dietrichiae* Boeck. in Flora 58: 122. 1875.

SOLOMON ISLANDS: San Cristobal: Waimamura, *Brass* 2660, August 1932, lowlands on pathways and in open swampy places in the rain-forests, plentiful (inflorescence brown).

Previously known to me with certainty only from Queensland. K  n  th, in Pflanzenr. IV.20: 264. 1909, regards *C. Dietrichiae* Boeck., *C. fissilis* Boott, and *C. indica* L. var. *Milnei* C. B. Clarke as synonymous, treating the group as *C. indica* var. *fissilis* (Boott) K  n  th. *Carex Dietrichiae* differs from *C. indica* L. in having shorter awns to the bracteoles, bright brown (not pallid) male glumes, and less spreading, less turgid utricles less abruptly constricted into their beaks. Mr. Nemes informs me that *C. fissilis* has much longer pistillate glumes than *C. Dietrichiae*.

I have not seen the specimens referred to *C. indica* var. *Milnei* by Ridley in Trans. Linn. Soc. II. Bot. 9: 247. 1916, nor those referred to *C. indica*

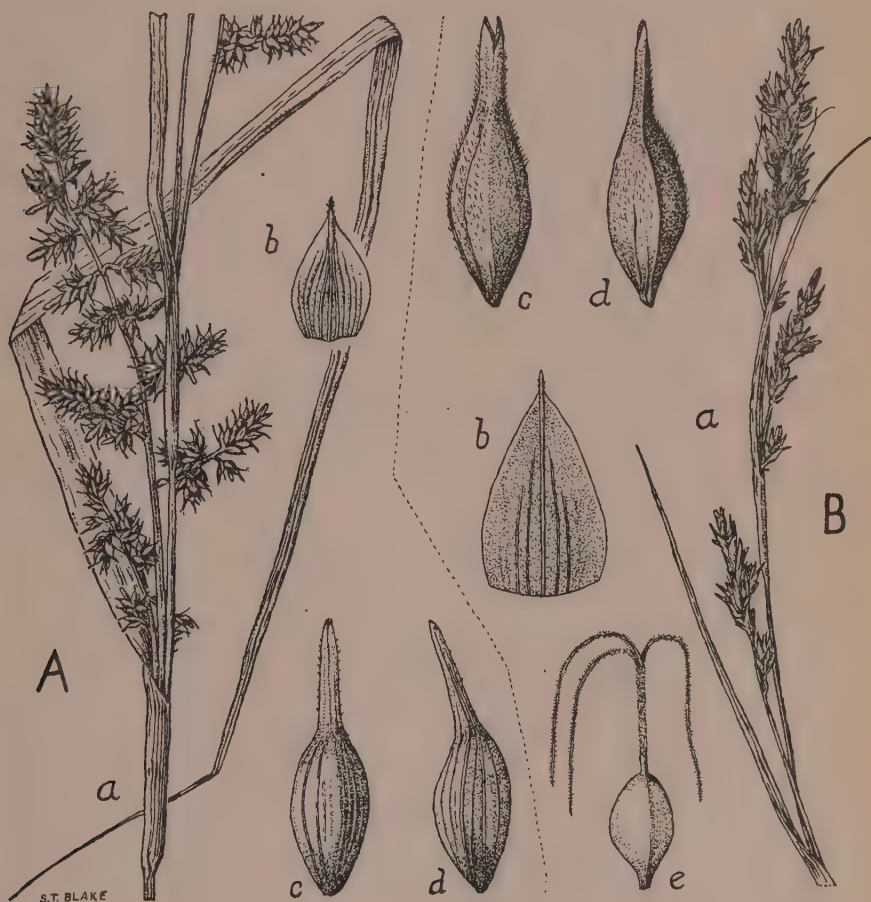


FIG. 2. A. *Carex lamprochlamys* S. T. Blake: a. part of middle region of inflorescence,  $\times 1$ ; b. pistillate glume, flattened out,  $\times 10$ ; c, d. utricle, dorsal and lateral views,  $\times 10$ . B. *Carex melanophora* S. T. Blake: a. upper part of inflorescence,  $\times 1$ ; b. pistillate glume, flattened out,  $\times 10$ ; c, d. utricle, dorsal and lateral views,  $\times 10$ ; e. nut with style,  $\times 10$ . All figures from type-specimens.



var. *fissilis* by Kükenthal in Bot. Jahrb. 59: 59. 1924. The specimen from New Guinea referred to *C. fissilis* by F. Mueller in Trans. Roy. Soc. Vict. 1(2): 36. 1889 belongs to *C. continua* C. B. Clarke.

*Carex lamprochlamys* sp. nov. (Sect. *Indicae* Tuckerm.). FIG. 2, A.

Herba robusta circa 75 cm. alta. Culmi subvalidi, acute triquetri, uninodes, glabri laevesque. Folia summam inflorescentiam haud attingentia, in apicem filiformem longe attenuata, acuta, 7–10 mm. lata, crebre striata, carinata, marginibus revoluta, supra scaberrima, subtus scabra, omnia laminifera, inferiora vaginis sanguineo-fuscis plus minusve persistentibus. Panícula plus quam dimidium culmum occupans, 7–8-nodis, composita, linearis, fere continua. Bractee longe vaginantes vaginis pallidis ampliatis prope os antice puberulis, inflorescentiam superantes, foliiformes, summae filiformes. Paniculae secundariae 12, singulae vel binae, oblongo-ovatae laxiusculae, erectae, exserte pedunculatae, plerumque 5–9 cm. longae et 2–3.5 cm. latae. Pedunculi erecti, exserti, graciles, rigidi, striati, scaberuli. Rhachis scaberrima. Bracteolae emarginatae, arista scabra longe aristatae. Spicae pallidae ferrugineo-tinctae, androgynaeceae, oblongae vel ovoideae, plerumque 6–8 (raro 5) mm. longae, circa 5 mm. latae, parte mascula partem femineam adaequante vel ea brevior. Glumae femineae fulvae, ovatae, acutae admodum acuminatae, aristulatae, pluristriatae, circiter 2 mm. longae. Utriculi pallidi, nitidi, membranacei, 3–3.5 mm. longi, 1 mm. lati, trigoni haud inflati, nervis prominulis circiter 15 notati, inferne elliptici vel obovati basi contracti, glabri laevesque, sursum in rostrum gracile planum fere rectum vel leviter excurvum ore integrum oblique sectum marginibus admodum scabrum cetero utriculo aequilongum subabrupte contracti. Nux 2 mm. longa, 0.9 mm. lata, brunnea, ellipsoidea utrinque acuta, triquetra, apice indistincte annulata, lateribus concava, basi breviter stipitata. Stylus basi incrassatus; stigmata 3.

PAPUA: Central Division: Mafulu, Brass 5323 (TYPE), Sept.–Nov. 1933, alt. 1250 m., common erect ground plant in *Castanopsis* forest; Boridi, Carr 13160, Sept. 1935, alt. ca. 4700 ft., young secondary forest (herb. ca. 2 ft. tall) (herb. Canberra).

Kükenthal cited Brass's collection under *C. Rafflesiana* Boott var. *continua* (C. B. Clarke) Kükenth., in Bull. Jard. Bot. Buitenz. III. 16: 315. 1940, and Carr's collection under *C. indica* L. in Bot. Jahrb. 69: 262. 1938. The species differs from *C. indica* L. and its immediate allies (subsect. *Turgidulae* Kükenth.) in that the utricle is not olivaceous, is by no means inflated, and is gradually attenuated into its beak, and differs further from *C. indica* itself in that the pistillate glumes are only shortly aristate. From *C. Rafflesiana* and its allies (subsect. *Hispidulae* Kükenth.) it differs in the stouter more rigid panicle and in that the utricle is but sparsely scabrous and then only on the narrow beak. By reason of the non-inflated utricle not abruptly narrowed into its slender only slightly scabrous beak, this species seems best placed in subsect. *Gracilirostres* Kükenth., but it is readily distinguished by its pallid shining mature utricle. Carr's specimen is a somewhat immature plant with a culm about 50 cm. high and leaves about 7 mm. wide.

*Carex continua* C. B. Clarke in Hook. f. Fl. Brit. Ind. 6: 717. 1894.

*Carex Rafflesiana* Boott var. *continua* (C. B. Clarke) Kükenth. in Philip. Jour. Sci. 6: 60. 1911, in Bot. Jahrb. 59: 59. 1924, in Bull. Jard. Bot. Buitenz. III. 16: 315. 1940.

NETHERLANDS NEW GUINEA: 4 km. southwest of Bernhard Camp, Idenburg River, *Brass* 13211, March 1939, alt. 850 m., rain-forest, one clump on river-bank; 4 km. southwest of Bernhard Camp, Idenburg River, *Brass* 13722, March 1939, alt. 850 m., occasional tufts on open banks of rain-forest stream; 15 km. southwest of Bernhard Camp, Idenburg River, *Brass* 12371, Jan. 1939, alt. 1500 m., rain-forest, one clump in sandy stream-bed; 18 km. northeast of Lake Habbema, Bele River, *Brass* 11225, Nov. 1938, alt. 2300 m., Fagaceae forest, common in moist hollows, clumps 50 cm. high. PAPUA: Central Division: Near summit of Owen Stanley Range at 9200 ft., *W. MacGregor* (herb. Melbourne); Mt. Tafa, *Brass* 4842, May–September 1933, alt. 2400 m., plentiful on roadside in forest; Mt. Tafa, *Brass* 5007, May–September 1933, alt. 2400 m., common roadside species, also found occasionally on forest floor; Mt. Tafa, *Brass* 5088, alt. 2400 m., May–September 1933, scattered on thinly vegetated face of an old landslide.

Not previously recorded for Netherlands New Guinea. *Brass* 5007 was cited by Kükenthal, in Bull. Jard. Bot. Buitenz. III. 16: 315. 1940, under *C. Rafflesiana* Boott var. *continua* (C. B. Clarke) Kükenth. Kükenthal also cites *Brass* 5323, 4391, and 4623 as belonging to this form; of these *Brass* 5323 serves as the type of the abundantly distinct *C. lamprochlamys* S. T. Blake, while nos. 4391 and 4623 are referred below to *C. neoguineensis* C. B. Clarke. MacGregor's specimen was referred to *C. fissilis* Boott by F. Mueller, in Trans. Roy. Soc. Vict. 1(2): 36. 1889.

Kükenthal's earlier opinion that *C. continua* C. B. Clarke is specifically distinct from *C. Rafflesiana* Boott seems preferable to treating it as a variety of the latter. The specimens seen from New Guinea and the Philippine Islands seem to form a homogeneous series. The species extends to the eastern Himalayas.

*Carex neoguineensis* C. B. Clarke in Jour. Linn. Soc. Bot. 37: 12. 1904, in Kew Bull. Add. Ser. 8: 73. 1908; Kükenth. in Pflanzenr. IV.20: 280. 1909, in Bot. Jahrb. 59: 59. 1924; Suring. in Nova Guinea Bot. 8: 713. 1912; Ridl. in Trans. Linn. Soc. II. Bot. 9: 246. 1916.

NETHERLANDS NEW GUINEA: Lake Habbema, *Brass* 9210, August 1938, alt. 3225 m., associated with *Sphagnum* and grasses in shrubby edges of forest; 9 km. northeast of Lake Habbema, *Brass* 10882, October 1938, alt. 2650 m., wet bank of an open stream in forest; 9 km. northeast of Lake Habbema, *Brass* 10925, October 1938, alt. 2800 m., common on wet sandy soil of openings in forest. PAPUA: Central Division: Mt. Albert Edward, *Brass* 4391, May–July 1933, alt. 3600 m., small colony on an open grassland slope (inflorescence brown); Mt. Victoria, *W. MacGregor* in 1889 (herb. Melbourne); Murray Pass, Wharton Range, *Brass* 4623, June–September 1933, alt. 2840 m., common on grasslands and recently burnt areas (leaves pale green, inflorescence brown); lower regions of British New Guinea, *W. MacGregor* in 1894 (herb. Melbourne).

The specimens cited show some variation between one another, particularly as to the size of the utricle. *Brass* 9210 and 4623 have small utricles 2.5–2.8 mm. long, while on *Brass* 10882 and *MacGregor's* specimens the utricles are 2.7–3.5 mm. long with longer more slender beaks. The type-specimen is described as having utricles 3 mm. long with the beak prominently toothed at the tip. All our specimens have an entire or emarginate tip of the utricle. Mr. E. Nelmes does not mention this character, but tells me that apart from the size and rather stouter beak the utricle of *Brass* 9210 is rather similar to that of the type and that the glumes are much alike. In view of the variation on Brass's specimens I

now have no hesitation in referring all the above-cited specimens to Clarke's species.

MacGregor's specimens have coarser leaves up to 10 mm. wide and the partial panicles sometimes paired, but the material is rather scrappy.

As mentioned in the discussion following *C. continua* above, *Brass* 4623 and 4391 were determined by Kükenthal as *C. Rafflesiana* Boott var. *continua* (C. B. Clarke) Kükenth. *Carex neoguineensis* is undoubtedly closely allied to *C. continua*, but it has more loosely flowered spikes with the utricles more abruptly contracted into a more slender trigonous prominently decurved beak, while the shorter stiffer leaves and bracts (the former usually not exceeding the base of the inflorescence, the latter only about as long as the partial panicles) and the shortly aristulate to mucous bracteoles give a different *facies* to the species.

*Carex melanophora* sp. nov. (Sect. *Indicae* Tuckerm. subsect. *Hispidulae* Kükenth.).

FIG. 2, B.

Herba stolonifera usque ad 4 dm. alta; stolones graciles usque ad 2.5 mm. crassi, squamis brunneis vel fuscis persistentibus obtecti. Culmi solitarii vel caespitosi, graciles, enodes, obtuse trigoni, striati ceterum laeves vel fere laeves, glabri. Folia prope basin culmi conferta, numerosa, recta, summam inflorescentiam fere attingentia, 2-3 mm. lata, apicem triquetrum versus longe attenuata, pro majore parte plana vel marginibus recurvula, conspicue carinata, crebre nervosa, costa supra appresse scabro-pubescentia ceterum glabra, marginibus (mediis exceptis) scaberula, carina sursum scabra, emortua persistentia; vaginae atropurpureae vel fuscae tandem in fibras dissolutae. Panicula composita,  $\frac{1}{2}$ - $\frac{2}{3}$  plantae occupans, linearis, densa, basi interrupta. Paniculae secundariae 14, plerumque binae, fuscae, oblongae vel anguste oblongae, dense spiciformes, plerumque 1-2.5 cm. longae, 5-7 mm. latae, superiores subsessiles approximatae, inferiores prominule pedunculatae, ima plus minusve distans solitaria. Bractee paniculas secundarias suas (interdum etiam inflorescentiam totam) superantes, superiores setaceae, inferiores foliiformes longiuscule vaginantes vaginis arctis antice tenuiter breviterque pubescentibus. Bracteolae squamiformes, aristatae, plus minusve hispidae. Pedunculi filiformes, erecti, scabri, imus usque ad 8 cm. longus. Rhachis scabra. Spicae androgynae, subapproximatae, appressae, oblongae, 4-6 mm. longae, 2-2.5 mm. latae; pars mascula partem femineam circa adaequans sed (utriculis circumdata) inconspicua. Glumae femineae sanguineo-fuscae, ovatae, acutae, muticae vel plus minusve cuspidatae, 2.5-3 mm. longae, tenuiter 5-nerves, carina tenui straminea. Utriculi fusci vel sanguineo-fusci, erecti, 3.5-3.8 mm. longi, 0.9-1 mm. lati, elliptici, utrinque angustati, subaeque subacutaeque trigoni, nervis 6-8 tenuibus (quorum interdum 2 solis conspicuis) notati, appresse scabro-pubescentes, marginibus hispiduli, in rostrum sensim abeuntes; rostrum rectum cetero utriculo aequilongum vel fere aequilongum, subgracile, compressum, ore albo-marginato profunde bidentatum (dentibus strictis), marginibus scabrum. Nux arcta, elliptica, stipitata, conspicue apiculata, acute triquetra lateribus concava, stramineo-brunnea, 1.6 mm. longa, 0.8 mm. lata. Stylus basi haud incrassatus; stigmata 3.

NETHERLANDS NEW GUINEA: North slopes of Mt. Wilhelmina, *Brass & Myer-Drees* 10046, Sept. 1938, alt. 3950 m., wet places in alpine grassland, common; northern



slopes of Mt. Wilhelmina, *Brass & Myer-Drees 10080*, Sept. 1938, alt. 3950 m., alpine grassland, matted on a rock; Mt. Wilhelmina, 7 km. northeast of top, *Brass & Myer-Drees 9828* (TYPE), Sept. 1938, alt. 3560 m., abundant on moist grassy cliffs.

*Carex melanophora* is evidently close to *C. sarawaketensis* Kükenth., but differs in the nodeless smooth stems, smaller partial panicles, smaller spikes, longer and perhaps more distinctly nerved utricles which are scabrous rather than hispid except on the margins of the beak, and perhaps also in the development of stolons. The three collections cited above are unlike each other at first glance, but they are indistinguishable as to their spikelets and appear to reflect differences of habitat. All specimens show at least a piece of a stolon. The type-sheet consists of two pieces 3 and 4 dm. high with narrow partial panicles the lower of which are distant and long-peduncled. *Brass & Myer-Drees 10080* consists of tiny plants up to 5 cm. high; they are immature but evidently represent starved plants. The third collection is intermediate with plants 7–13 cm. high, not quite mature, with fairly dense inflorescences with the lower partial panicles shortly pedunculate and thicker than in the type. The utricles are somewhat larger than in the type, 4–4.5 mm. long and 1.1–1.2 mm. wide. It would appear that the usual length of the utricle of the species varies from 3.5 to 4.2 mm.

*Carex rhizomatosa* Steud. in Zoll. Verz. Ind. Archip. 60: 1854; Kükenth. in Bot. Jahrb. 59: 60. 1924, 69: 264. 1938, in Bull. Jard. Bot. Buitenz. III, 16: 316. 1940.

PAPUA: Central Division: Mafulu, *Brass 5318*, Sept.–Nov. 1933, alt. 1250 m., common amongst tall grass of deforested spurs.

This collection differs from the general run of the species in the somewhat smaller nearly smooth utricles 2.5 mm. long. It was previously cited by Kükenth. in Bull. Jard. Bot. Buitenz., l. c. The species ranges from Assam and Burma to New Guinea.

#### Subgen. *Eucarex* Coss. & Germ.

*Carex Gaudichaudiana* Kunth, Enum. 2: 417. 1837; Ohwi in Bot. Mag. Tokyo 56: 215. 1942.

NETHERLANDS NEW GUINEA: Lake Habbema, *Brass 9234*, August 1938, alt. 3225 m., common on marshy banks of streams; Mt. Wilhelmina, 7 km. northeast of top, *Brass & Myer-Drees 9923*, Sept. 1938, alt. 3700 m., few plants on boggy grasslands.

The specimens are small and immature, corresponding to var. *humilior* Kükenth. in Pflanzenr. IV.20: 313. 1909, which was recorded for Northeast New Guinea in Bot. Jahrb. 69: 264. 1938. To judge from the range of variation seen in Australian plants this small state is not worth taxonomic recognition. The species occurs in southeastern Australia (including Tasmania) and New Zealand and was recently recorded for Netherlands New Guinea by Ohwi, l. c.

*Carex phacota* Spreng. Syst. 3: 826. 1826; Ohwi in Bot. Mag. Tokyo 56: 214. 1942.

PAPUA: Eastern Division: Summit of Mt. Dayman (herb. Melbourne, without further data).

New for Papua; recorded by Ohwi, l. c., for Netherlands New Guinea, otherwise known from Nepal and Japan to Java. The sheet carries an old

herbarium label marked in the handwriting of F. Mueller "Carex Summit of Mt. Dayman," to which J. H. Willis has added "New Guinea (ca. 1894)."

*Carex euphlebia* sp. nov. (Sect. *Acutae* Fries). FIG. 3, C.

Herba dense caespitosa rhizomate brevi. Culmi caespitosi, cum inflorescentia 30–65 cm. alti, graciles, acute triquetri, sursum scabridi, usque ad medium foliati, basi vaginis nigricantibus nitidulis obtecti. Folia coriacea, inflorescentiam longe superantia, 2.5–5.5 (pro more 3–5.5) mm. lata, in apicem acutum fere planum scabrum longe attenuata, plerumque plana sed marginibus scaberrimis plus minusve recurva vel revoluta, nervis primariis scabra; vagina summa perlonga, inferiores persistentes, intermediae tandem in fibras plus minusve reticulatas fissae. Bractae evaginantes, 2–3 inferiores foliiformes inflorescentiam superantes, ceterae breviores, summae squamiformes. Pedunculi capillares, tenaci-flexiles. angulis scabri, imus usque ad 5 cm. longus. Spicae 10–14, singulatim dispositae, vix distantes, lineari-cylindricae, atro-fuscae, densiflorae, inferiores pedunculatae plus minusve nutantes, superiores subsessiles patulae; terminalis mascula, interdum basi breviter feminea, 5–12 mm. longa; ceterae androgynae, 2–6 (plerumque 3–5.5) cm. longae, 4.5–5 mm. crassae, in  $\frac{1}{4}$ – $\frac{1}{2}$  partem superiorem masculam, circiter 1.5 mm. crassam, abrupte angustatae. Glumae femineae violaceo-nigrae, dorso viridulo 3-nerves, margine angustissime albo-hyalinae, 1.5–1.8 mm. longae, oblongo-ovatae, plus minusve obtusae, cuspidate plana scabra glumam fere adaequante vel ea breviorae praeditae. Utriculi pallide brunnei, glumam superantes vel multo superantes, 1.8–2.2 mm. longi, 0.9–1 mm. lati, tandem divaricati, biconvexi, elliptici utrinque acuti vel apice breviter subacuminati, ore minute truncati vel emarginati, 14–16-costati, sursum punctulati ceterum laeves, glabri. Nux utriculo brevior aequilata, elliptica, biconvexa, brunnea, circiter 1.4 mm. longa. Stylus exsertus; stigmata 2.

NETHERLANDS NEW GUINEA: 9 km. northeast of Lake Habbema, *Brass 10877* (TYPE), October 1938, alt. 2650 m., common on open banks of a stream; 9 km. northeast of Lake Habbema, *Brass 10559*, October 1938, alt. 2800 m., few scattered clumps in stony bed of stream; 9 km. northeast of Lake Habbema, *Brass 10734*, October 1938, alt. 2800 m., common about native huts on open banks of stream, etc., clumps 50–60 cm. high. PAPUA: Central Division: Mt. Albert Edward, *Brass 4386*, May–July 1933, alt. 3800 m., amongst coarse tussock grass on deforested slope (stiff sedge in broad spreading tussocks).

*Brass 4386* was determined by Kükenthal, in Bot. Jahrb. 69: 264. 1938, as *C. Graciflora* Boott, from which it differs in the narrower leaves, fewer shorter coarser spikes, and rather longer utricles acute at the base and with more numerous nerves. It appears to be closely allied to *C. Pandanus* Ohwi, in Bot. Mag. Tokyo 56: 214. 1942, from Netherlands New Guinea, but has much longer leaves with more persistent sheaths, commonly cuspidate glumes, and darker coloured, rather smaller, elliptical (not obovate) utricles punctulate in the upper part. It is also close to *C. philippinensis* Nelves, in Kew Bull. 1938: 109. 1938, differing in that the terminal spike is usually male, in the rather more slender spikes, in the ovate rather than obovate glumes, and in the smaller elliptic (not obovate) smooth paler coloured utricles which is less obtuse at the base.

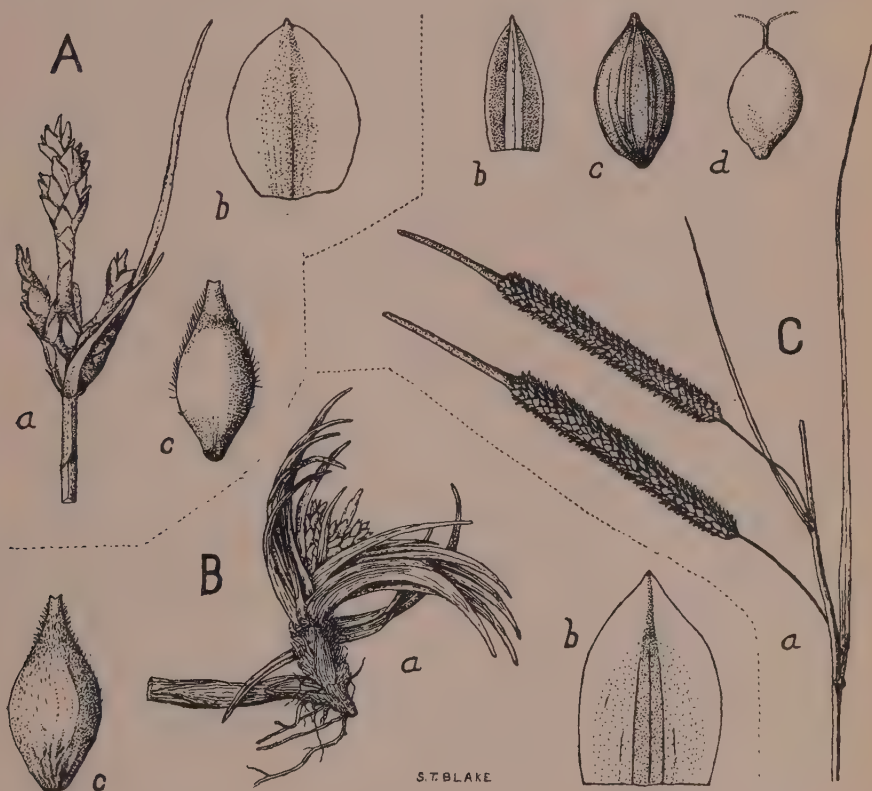
On the type specimen, selected as such because of its full maturity,

there are 13 spikes and the glumes are muticous or shortly pointed. *Brass* 10734 measures 22 cm. to the top of the inflorescence and has 10 spikes rather shorter than those on the type (up to 3.5 cm. long), with which it otherwise agrees. *Brass* 4386 is similar to the type in appearance, but is not quite so mature; it carries 10 spikes and the glumes are rather prominently awned. *Brass* 10559, also with 10 spikes, is immature, and the uppermost spike has a few female flowers at the base.

*Carex montivaga* nom. nov.

*Carex bulbostylis* Kükenth. in Bot. Jahrb. 69: 264. 1938; non Mackenzie in Bull. Torr. Bot. Club 42: 617. 1915.

NETHERLANDS NEW GUINEA: Lake Habbema, *Brass* 9032, August 1938, alt. 3225 m., common on wet sandy soil of open ridges; Lake Habbema, *Brass* 9339, August 1938, alt. 3225 m., common on sandy patches on wet grassy slopes; Lake Habbema, *Brass* 9582, August 1938, alt. 3225 m., alpine grassland, tufted in a sandy pool; 11



S. T. BLAKE

FIG. 3. A. *Carex tricholoma* S. T. Blake: a. apex of culm with inflorescence,  $\times 2$ ; b. pistillate glume, flattened out,  $\times 10$ ; c. nut,  $\times 10$ . B. *Carex brevis* S. T. Blake: portion of plant,  $\times 1$ ; b. pistillate glume, flattened out,  $\times 10$ ; c. utricle, dorsal view,  $\times 10$ . C. *Carex euphlebia* S. T. Blake: a. portion of middle part of inflorescence,  $\times 1$ ; b. pistillate glume, flattened out,  $\times 10$ ; c. utricle, dorsal view,  $\times 10$ ; d. nut with style,  $\times 10$ . Fig. A, a from *Brass* 4274; remainder from type-specimens.



km. northeast of top of Mt. Wilhelmina, *Brass & Myer-Drees* 9759, Sept. 1938, alt. 3450 m., in small bog.

Kükenthal based his species on part of *Clemens* 6069, from Sarawaket in Northeast New Guinea. I have not seen the material, but the specimens cited above, particularly *Brass* 9339, agree so well with the description that there seems no doubt they are conspecific. The following notes on these specimens may be regarded as an amplification of the original description: Culms 18–42 cm. high; spikes 3–4, the terminal one male and 8–12 mm. long, the others female and up to 12 mm. long (8–12 mm. on *Brass*'s specimens, 6–10 mm. on the type); the lowermost bract occasionally has a very short sheath; and the utricles vary from 3 to 3.6 mm. long.

*Carex tricholoma* sp. nov. (Sect. *Mitratae* Kükenth.). FIG. 3, A.

*Carex bulbostylis* Kükenth. var. *ciliato-marginata* Kükenth. in Bull. Jard. Bot. Buitenz. III. 16: 318. 1940, in Bot. Jahrb. 70: 464. 1940; non *C. ciliato-marginata* Nakai.

Rhizoma breve. Culmi caespitosi, circa 15–30 cm. alti, graciles, trigoni, striati, prope apicem subtiliter scabri vel laeves. prope basin foliati. Folia omnia laminifera, culmo multo breviora, rigida, suberecta, sursum gradatim angustata sed apice ipsa anguste praemorsa, conspicue carinata, marginibus recurva ceterum plana, prope apicem triquetra, carina et marginibus et facie superiore scabra; vaginae brunneae, hirtellae, emortuae in fibras reticulatas dissolutae. Bractea ima inflorescentiam adaequans, angusta sed vix setacea, breviter vaginans, ceterae breves vel squamiformes. Spicae 3–4, brunneae, contiguae vel ima breviter distans, sessiles vel breviter pedunculatae, interdum etiam spica basali longissime pedunculata addita; terminalis gynaeandra, clavata, circiter 10–12 mm. longa, inferne circiter 1.5 mm. sursum 3–4 mm. crassa; laterales femineae, oblongo-cylindricae, 7–10 mm. longae, circiter 3 mm. crassae, densiflorae. Glumae femineae 2–2.3 mm. longae, late ovatae, obtusae vel fere obtusae, muticae vel cuspidatae, brunneae, dorso pallidae subtiliter 1-nerves, marginibus anguste hyalinae. Utriculi glumam brevissime superantes, 2.3–2.5 mm. longi, 0.95 mm. lati, membranacei, straminei nervis valde obscuris, marginibus lateralibus manifeste ciliati, faciebus glabri laevesque, elliptici, trigoni angulis lateralibus conspicuis, in rostrum breve conicum brunneum ore fulvescente minute bidentulum marginibus ciliatum sensim contracti. Nux cinerea, 1.5 mm. longa, 0.9 mm. lata, oblongo-ovalis obtuse trigona, anguste tricostulata, lateribus convexa, sub apice annulata constricta. Stylus brevissimus, basi pyramidalis; stigmata 3.

PAPUA: Central Division: Mt. Albert Edward, *Brass* 4274, May–July 1933, alt. 3680 m., few plants amongst grass on banks of a grassland pond; Mt. Albert Edward, *Brass* 4316 (TYPE), May–July 1933, 3680 m., sporadic in forest glades, not common.

*Carex tricholoma* differs from *C. montivaga* S. T. Blake (*C. bulbostylis* Kükenth. non Mackenzie) in the broader more scabrous leaves, prominently sheathing lowermost bract, gynaeandrous terminal spike, and in the smaller very shortly beaked utricle prominently ciliate on the lateral margins nearly throughout its length. Kükenthal founded his variety solely on *Brass* 4316 and I have accepted a specimen of this number as the type of the species described above, but the excellent specimen *Brass* 4274 was found useful in elucidating some of the details.

A small plant in herb. Brisbane collected by M. S. Clemens on Mt. Sarawaket, at 9–13000 ft. in April 1937, may belong to this species, but the specimen is not sufficiently satisfactory for definite determination.

*Carex brevis* sp. nov. (Sect. *Mitratae* Kükenth.). FIG. 3, B.

*Carex bulbostylis* Kükenth. var. *hispidula* Kükenth. in Bull. Jard. Bot. Buitenz. III. 16: 318. 1940, in Bot. Jahrb. 70: 464. 1940; non *C. hispidula* Gaud.

Herba humilis caespitosa; rhizoma oblique descendens lignosum. Culmi (inflorescentia inclusa) circiter 2–5 cm. alti, sub inflorescentia vaginis foliorum obtekti, basi admodum incrassati. Folia multa, rigida, patula vel admodum decurva, stricta vel plus minusve curva culmis multo longiora, sensim acutata, transversim secta plerumque V-formia, apice triquetra angustissima obtusa, 2–5.5 cm. longa, 3–4 mm. lata, valde striata, inferne carina marginibusque dense subtiliterque scabra, sursum undique scabra; vaginae brunneae tandem in fibras plus minusve reticulatas dissolutae. Bractae foliiformes inflorescentiam superantes, conspicue vaginantes, vaginis antice admodum pubescentes, superiores angustiores. Spicae 4 approximatae, breviter pedunculatae, erectae, pallide brunneae vel fulvescentes; terminalis mascula linearis 7–8 mm. longa, 1.5 mm. lata; laterales femineae, singulae, oblongae, 5.5–8 mm. longae, circiter 3 mm. latae, subdensiflorae, interdum spicis basalibus longepedunculatis additis. Pedunculi graciles scaberuli. Glumae femineae tenuiter membranaceae, 2.4–2.5 mm. longae, 1.8 mm. latae, ovatae, obtusae vel acutae, muticae, concavae, dorso lutescenti tenuiter 3-nerves vix carinatae, lateribus hyalinae fulvo-tinctae; glumae masculae plus minusve acutae, inferiores carina scabrae. Utriculi fulvi, coriacei, 2.5–2.6 mm. longi, 1.15 mm. lati, obscure nervati (nervis lateralibus saepe etiam 2 alioribus prominulis), apice basique exceptis undique dense hispiduli, elliptici, obtuse trigoni, basi leviter rotundati, sursum in rostrum brevissimum conicum ore hyalinum sensim contracti. Nux straminea, 1.5 mm. longa, 0.9 mm. lata, ovoidea, obtusa, sub apice annulata abrupte constricta, subtiliter 3-costata, lateribus fere plana. Stylus basi pyramidalis; stigmata 3.

PAPUA: Central Division: Mt. Albert Edward, *Brass* 4418 (TYPE), May–July 1933, alt. 3680 m., common in small tufts on a barren rocky ridge crest (leaves very stiff).

Described by Kükenth. as a variety of *C. bulbostylis* Kükenth. non Mackenzie (*C. montivaga* S. T. Blake), but it differs greatly from that species in appearance, in the stiffer broad leaves, included culms, sheathing bracts, pedunculate female spikes with muticous glumes (usually not muticous in *C. montivaga*), and rather shorter very shortly beaked densely hispidulous yellowish utricles. The rhachilla is well developed and is sometimes so long as to be exerted from the utricle when it bears another utricle, sometimes well developed, sometimes rudimentary. At times the glumes appear cuspidate due to the inrolling of their upper margins.

In Bull. Jard. Bot. Buitenz. III. 16: 318. 1940, Kükenth. cites three collections under his *C. bulbostylis* var. *hispidula*, namely *J. & M. S. Clemens* 29005 and *Clemens* 32344 from Borneo and *Brass* 4418, without designating the type. In the same year, in Bot. Jahrb. 70: 464, the same description is given, but the collections are cited as follows:

“Südöstl. Neu-Guinea: Mt. Albert Edward (*Brass* n. 4418!).

Area: Brit. Nordborneo, Mt. Kinabalu (*Clemens* n. 29005!; 32344!).”

Under these circumstances we may consider that in the latter publication Kükenthal emphasised that *Brass* 4418 represented his variety, so that this may be regarded as the type of his trinomial. I have not seen the Clemens specimens. In any case the type of the binomial *C. brevis* is the sheet of specimens of *Brass* 4418 in herb. Brisbane.

*Carex breviculmis* R. Br. Prodr. 242. 1810; Ridl. in Trans. Linn. Soc. II. Bot. 9: 247. 1916.

*Carex breviculmis* R. Br. subsp. *Royleana* Nees ex Wight sensu Kükenth. in Bull. Jard. Bot. Buitenz. III. 16: 318. 1940, in Bot. Jahrb. 70: 464. 1940.

PAPUA: Central Division: Murray Pass, Wharton Range, *Brass* 4697, June-Sept. 1933, alt. 2840 m., pale species scattered on grassland slopes.

I do not see how these specimens differ from the general trend of the species in Eastern Australia, unless the utricles are somewhat less pubescent. The length of culm varies considerably, sometimes even on the same plant, and evidently has no taxonomic importance in this species. I have seen no authentic specimen of subsp. *Royleana*, which is said to have somewhat scabrous culms; the other characters described are to be found in characteristic *C. breviculmis*.

*Carex constricta* sp. nov. (Sect. *Frigidae* Fries subsect. *Decorae* Kükenth.). FIG. 4, A.

Herba pygmaea caespitosa stolonifera phyllopoda. Culmus 4 cm. altus, intra folia absconditus et horum vaginis obtectus. Folia numerosa, culmum superantia, usque ad 5 cm. longa, 2-3 mm. lata, plana, sensim acuta, perrigida, carinata, sursum carina marginibusque scabra; vaginae purpurascens diu integrae sed tandem in fibras fissae. Inflorescentia e spicis 6 erectis constructa; spica terminalis mascula linearis circiter 7 mm. longa et 1.2 mm. crassa, breviter pedunculata; spicae laterales femineae, ima excepta geminatae, oblongae, subdensiflorae, 5-11 mm. longae, sub fructu 3.5-4 mm. crassae, breviter pedunculatae pedunculis e vaginis haud vel vix exsertis. Bractae inflorescentiam superantes, foliiformes, prominule vaginantes. Glumae femineae oblongo-ovatae, truncatae vel bilobae, aristulatae, carina angusta basi 3-nervi virides, lateribus rufescentes aut ferrugineae, marginibus anguste hyalinae, 2.2-2.5 mm. longae (aristula usque ad 0.3 mm. longa inclusa). Utriculi oblique patentes, 2.3-2.6 mm. longi, circiter 1 mm. lati, membranacei, acute triquetri, leviter compressi, lateribus fere plani, 2-nerves, glabri, minute rugulosi nitidule fusco-olivacei, inferne elliptici basin versus attenuati, sursum in rostrum obliquum circiter 0.7 mm. longum marginibus scabrum ore hyalinum obliquum integrum vel bidentulum subabrupte contracti. Nux arcte inclusa, fere atra, ellipsoideo-ovoidea, tricostata, lateribus convexa, sub apicem ipsum dilatatum annulatum constricta. Stylus basi incrassatus; stigmata 3.

PAPUA: Central Division: Mt. Victoria, Owen Stanley Range, *W. MacGregor* in 1889 (TYPE in herb. Melbourne); photographs of specimen with analytical drawings in herbs. Gray, Brisbane, and Kew).

A single piece seen with one fruiting culm. In habit it appears to be close to *C. celebica* Kükenth., differing (so far as can be judged from the description) in the truncate mucronate (not acute) glumes and coarser spikes with more spreading utricles. Kükenthal describes the spike of *C. celebica* as 1½ mm. thick, but it is not clear whether this refers to the



flowering or the fruiting spike. The nut of *C. constricta* is similar to that of the *Mitratae*, but the geminate spikes and shape of the glumes do not accord with this section.

*Carex tricuspidata* Kükenth. in Bot. Jahrb. 70: 466. 1940.

NETHERLANDS NEW GUINEA: Mt. Wilhelmina, 4 km. northeast of top, Brass & Myer-Drees 9970, Sept. 1938, alt. 3650 m., tufted on grassy seepages; Mt. Wilhelmina, 11 km. northeast of top, Brass & Myer-Drees 9803, Sept. 1938, alt. 3400 m., covering the sandy bottom of a stream.

Previously known only from Northeast New Guinea. The specimens cited evidently belong to Kükenthal's species, though collectively they

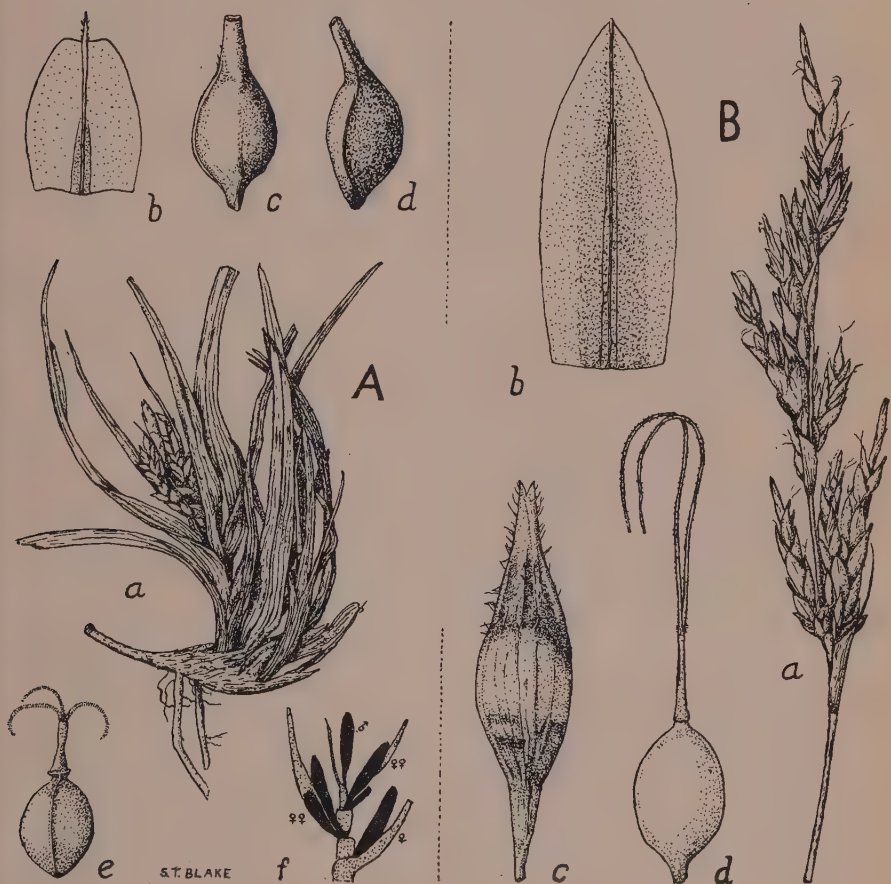


FIG. 4. A. *Carex constricta* S. T. Blake: a. plant,  $\times 1$ ; b. pistillate glume, flattened out,  $\times 10$ ; c, d. utricle, dorsal and lateral views,  $\times 10$ ; e. nut with style,  $\times 10$ ; f. diagram of inflorescence (spikes in solid black, bracts stippled). B. *Carex acrophila* S. T. Blake: a. upper part of inflorescence,  $\times 1$ ; b. pistillate glume, flattened type-specimens.

differ from the description in that the spikes are up to 6 cm. long, sometimes all distinct from one another (not up to 4 cm. long with the two uppermost female ones fastigate), in that the utricle is only about 3.5 mm. (3.3–3.6 mm.) and not 4 mm. long, and in that the basal leaf-sheaths ultimately break up into fibres, while an elongated rhizome appears sometimes to be present. The inflorescence of *Brass & Myer-Drees 9970* agrees pretty well with Kükenthal's description, but on this specimen the basal sheaths are broken up into fibres. In the other collection the plants are more elongated with longer and more distant spikes. The basal leaf-sheaths are but little disintegrated and evidence of an elongated rhizome is present.

*Carex brunnea* Thunb. Fl. Japon. 38. 1784; Kükenth. in Bot. Jahrb. 59: 60. 1924, 69: 265. 1938.

NETHERLANDS NEW GUINEA: 9 km. northeast of Lake Habbema, *Brass 10924*, October 1938, alt. 2800 m., shrubby edges of a land-slip, rare; Bele River, 18 km. northeast of Lake Habbema, *Brass 11592*, Nov. 1938, alt. 2200 m., occasional large clumps on grassy, formerly cultivated slopes.

New for Netherlands New Guinea, previously recorded from Northeast New Guinea. Known from the Mascarene Islands, Ceylon, E. Asia and Japan, Indo-Malaya, Queensland, N. S. Wales, and New Caledonia.

*Carex acrophila* sp. nov. (Sect. *Hymenochlaenae* Drejer subsect. *Graciles* Tuckerm.).

FIG. 4, B.

Rhizoma brevissimum. Culmi caespitosi, erecti, cum inflorescentia 25–60 cm. alti, gracillimi (usque ad 0.9 mm. crassi), obtuse trigoni, sursum angulis admodum scaberuli, glabri, enodes, basi solum foliati. Folia prope basin culmi stipata, inflorescentiam superantia, rigida, stricta vel prope apicem flexuosa, plerumque laxe conduplicata, valde carinata, explanata usque ad 1.6 mm. lata, in apicem longe filiformem sensim attenuata, ad superficiem superam atque ad margines atque ad carinam superam debiliter laxiusculeque scabro-pilosula; vaginae fusco-brunneae vel fuscae, lucidulae, plerumque integrae, imae elaminatae. Panícula simplex, 7–15 cm. longa. Bractae setaceae, breves, summam inflorescentiam raro attingentes, longe vaginantes, vaginis clare brunneis. Spicae 12–20, saturate brunneae, plerumque ternae vel binae (interdum singula), breviter pedunculatae, androgynae (pars mascula parte feminea brevior angustiorque), lineari-cylindricae, plerumque 1.5–3.5 cm. longae, 3 mm. crassae, subdensiflorae. Glumae femineae 4.5–5.5 mm. longae, elliptico-oblongae, acutae, muticae vel aristulatae, ferrugineae marginibus anguste hyalinae. dorso crebre 3-nerves anguste carinatae, lateribus striatae. Utriculi suberecti glumas superantes, saturate rufo-brunnei, 5–5.5 mm. longi, 1–1.2 mm. lati, membranacei, nervis circiter 15 notati, praecipue parte superiore marginibusque hispidi, angustius ovoidei, plano-convexi, inferne in stipitem graciliorem 1–1.4 mm. longum conspicue angustati, sursum in rostrum gracile fuscum bidentulum circiter 1.3 mm. longum subsensim contracti. Nux utriculo multo brevior, late elliptico-oblonga, plano-convexa, 1.75–2 mm. longa, 1.2 mm. lata, brunnea. Stylus tenuis, basi admodum incrassatus; stigmata 2, circiter 5 mm. longa.

NETHERLANDS NEW GUINEA: Lake Habbema, *Brass 9515* (TYPE), August 1938, alt. 3225 m., common about native camps; northern slopes of Mt. Wilhelmina, *Brass & Myer-Drees 10072*, Sept. 1938, alt. 4050 m., common on old grassy screes; Mt.

Wilhelmina, 7 km. northeast of top, *Brass & Myer-Drees 9829*, Sept. 1938, alt. 3560 m., alpine grassland, occasional erect tufts on wet ground; Mt. Wilhelmina, 7 km. northeast of top, *Brass & Myer-Drees 9926*, Sept. 1938, alt. 3560 m., plentiful amongst long grasses of a marshy slope, slender tufts 70–90 cm. high; Mt. Wilhelmina, 5 miles east of top, *Brass 9409*, August 1938, alt. 3440 m., common in marshy hollows.

This may be the form described by Kükenth. as *C. brunnea* Thunb. var. *subteiogyna* Kükenth., in Rep. Sp. Nov. 8: 8. 1910, from the Philippine Islands (not *C. subteinogyna* Ohwi in Mem. Coll. Sci. Kyoto Imper. Univ. ser. B, 11(5): 469, *pl. 15, text-fig. 17*. 1936), but it differs from *C. brunnea* in the nearly smooth rigid less flattened narrower leaves, the short peduncles, the longer glumes, the longer long-stipitate utricles less suddenly contracted into the beak and in the nut much shorter than the utricle. *Carex acrophila* is closely allied to *C. teinogyna* Boott, from India and Burma, but differs in the denser inflorescence, the shorter peduncles, the utricles with a longer stipe and more gradually narrowed to a shorter beak with shorter teeth, the shorter nut and rather shorter stigmas. It is also evidently close to *C. spathaceo-bracteata* Kükenth., in Bot. Jahrb. 70: 466. 1940, from Northeast New Guinea, differing in the less rough stems and leaves, 2–3-nate (not 3–5-nate) spikes, longer not conspicuously dilated sheaths to the bracts, paler glumes, and larger utricles hispid on the sides as well as on the margins.

The cited collections form a very homogeneous series, varying from one another almost exclusively in the height of the plant. The nut is occasionally subtrigonus.

*Carex Brownii* Tuckerm. Enum. Meth. 21. 1843.

NETHERLANDS NEW GUINEA: Balim River, *Brass 11791*, Dec. 1938, alt. 1600 m., frequent in shallow grassy pools, erect tufts 50–60 cm. high.

New for New Guinea; known elsewhere from Japan, Korea, New South Wales, and New Zealand.

*Carex subtransversa* C. B. Clarke in Philip. Jour. Sci. 2(C): 108. 1907.

PAPUA: Central Division: Murray Pass, Wharton Range, *Brass 4676*, June–Sept. 1933, alt. 2840 m., a few plants at edge of forest (leaves pale, inflorescence erect).

New for New Guinea; previously known from the Philippine Islands and Japan.

*Carex Doniana* Spreng. Syst. 3: 825. 1826.

PAPUA: Central Division: The Gap, *Carr 13731*, Dec. 1935, alt. 7200 ft., open ridge top (herb, 1 ft. tall) (herb. Canberra).

New for New Guinea. This collection was cited along with *Clemens 4451* and *Clemens 5551* under the original description of *C. japonica* Thunb. var. *mesogyna* Kükenth., in Bot. Jahrb. 69: 265. 1938, but it differs from the description in that the terminal spike is wholly male, not female in the middle. It matches one piece of *Ramos & Edaño in Philip. Bur. Sci. 40359*. There are two pieces under this number in herb. Brisbane, apparently representing the same form, the larger one agreeing with Kükenth.'s description of *C. japonica* Thunb. var. *chlorostachys* Kükenth., the second piece, matched by the Carr sheet, being smaller and with narrower leaves. *Carex Doniana* appears to be sufficiently distinct from *C. japonica* Thunb.



by reason of the longer cylindrical more shortly pedunculate always erect spikes and usually broader leaves.

*Carex subtransversa* C. B. Clarke is very similar in appearance to *C. Doniana*, but has less spreading rather broader less distinctly nerved utricles with rather longer beaks, and the style is oblique and scarcely swollen at the base.

*Carex fascicularis* Soland. ex Hook. f. Fl. Nov. Zel. 1: 283. 1853.

NETHERLANDS NEW GUINEA: Lake Habbema, *Brass* 9211, August 1938, alt. 3225 m., lining open lake-shores, on hummocked marshy ground, large erect clumps 60–100 cm. high.

New for New Guinea; previously known only from eastern Australia and New Zealand.

There remain three collections of which the specimens are not sufficiently complete for satisfactory determination. *Brass* 9235, from sunny bogs, Lake Habbema, 3225 m., consists of small plants evidently allied to *C. stenophylla* Wahlenb., of the Northern Hemisphere, but the utricles are far too undeveloped for certain determination. *Brass* 11540, from the open banks of the Bele River, 2200 m., is an *Indocarex* allied to *C. filicina* Nees and *C. saturata* C. B. Clarke. It almost certainly represents an undescribed species, but as the most advanced utricles are not quite mature it seems inadvisable to attempt to describe it until more mature material is available. And finally, *Brass* 4407, from a broken cliff face on Mt. Albert Edward at 3680 m., appears to represent an undescribed species of the *Mitratae*, but only very immature flowers and one overmature utricle are present on the specimen.

QUEENSLAND HERBARIUM,

BRISBANE, QUEENSLAND, AUSTRALIA.

## NOTES ON SOME PLANTS OF CUBA

RICHARD A. HOWARD

*With two plates*

THE PLANTS described in this paper were collected in Cuba in the summer of 1941 by the author. Headquarters during this collecting trip was the Atkins Institution of the Arnold Arboretum, at Soledad in southern Las Villas province. I am grateful to Mr. David Sturrock and the administration of the Soledad gardens for their many courtesies and for the privileges of using the facilities of the station.

Most of my collections during that summer were made in the San Juan and Trinidad Mountains and in southern Las Villas province. One short trip was made to the Oriente province with Brother Leon, of the Colegio de la Salle of Havana, and many of the new entities described in this paper were collected then. The trip to the Oriente and the territories in which collections were made were described by Brother Leon under the title, "Excursion Botanica a las Tierras de Moa" (De La Salle No. 225: 23-29, 1941). The collection numbers cited are my own. I am grateful to Brother Leon for the pleasure of accompanying him on that trip and also to Mr. George Bucher and Mr. J. R. Grist for the hospitality and assistance offered during our stay at Moa.

The description of a new species of *Neobracea* was supplied by Dr. Robert E. Woodson, Jr., of the Missouri Botanical Garden, and I am grateful to him for examining this material and supplying the name.

*Rajania nipensis* sp. nov. PLATE I, FIGS. 1-8.

Planta volubilis glabra; foliis 5-7 cm. inter se remotis; petiolis 3-4 cm. longis, teretibus; laminis late triangularibus vel ovato-triquetris vel trilobis, 6 cm. longis, 5-6 cm. latis, basi rotundatis vel truncatis, lobo medio lineari-attenuato, e basi 4 cm. longo, 1 cm. lato, 3-nervio, nervis lateralibus medio parallelibus margine supra medium confluentibus; lobis lateralibus oblongis vel rotundis, cum nervis 2 (3) arcuatis; inflorescentiis 2 vel 3 axillaribus, racemosis vel spicatis, 2.5-3.5 cm. longis; floribus congestis, cymis brevibus 0.5 mm. longis, 1-3-floris; perianthii segmentis ovatis, 6; staminibus 6, usque 0.3 mm. longis, antheris ovatis, introrse dehiscentibus.

ORIENTE: Sierra de Nipe near Woodfred, in flower July 28-29, 1941, Howard 6136a (GH, TYPE).

*Rajania nipensis* is similar to *R. prestoniensis* Knuth. It differs in having leaves which are rounded or truncate at the base and without a sinus. In addition, the middle lobe is 3-nerved and attenuate, not mucronate as in *R. prestoniensis*.

In the collection cited above is a single pistillate specimen tangled with

the staminate shoots selected as the type. This pistillate specimen has the mature leaves elongate-ovate, with the basal lobes rounded or poorly defined. The size and venation are approximately the same as in the type specimen. The pistillate inflorescences are fascicled in the leaf-axils, 3-5 being present per axil. The branches are racemose and 7-10 cm. long, although one or two measure 19 cm. in length. The individual flowers are solitary on pedicels nearly 2 mm. long which bear a lanceolate bract near the base. The flowers are 1-1.5 mm. high, with a 6-parted perianth. The perianth-segments are ovate and average 0.5 mm. in length. There are 6 staminodes present in the flower and these are minute and bifid at the apex. The three styles are well developed and also bifid. The ovary is strongly 6-lobed, the alternate lobes being large and small. Dissection of the small lobes reveals the locules, which are almost lost in the mass of sterile tissue. One locule is usually larger than the others and the ovules in this appear turgid. The other locules also have two superposed ovules but these are shrunken. Only a faint indication of a lateral gibbosity is developed in the specimen at hand; however, the condition of the ovules indicates that but one locule will develop and that the specimen is a true *Rajania*.

The young leaves are distinctly punctate-glandular, but the glands are fairly well masked in the mature lamina.

*Rajania linearis* (Griseb.) [Uline in msc. ex Knuth in syn.] Howard, comb. nov.

PLATE I, FIG. 9.

*Dioscorea linearis* Griseb. Cat. Pl. Cub. 251. 1866.

ORIENTE: Sierra de Nipe, 15 km. south of Woodfred, Howard 6096 ♂. Collected in flower July 28-29, 1941.

The specimens cited above are staminate, but they appear to be identical with a pistillate specimen collected by Wright (3254, type number of *D. linearis* Griseb.) in the Gray Herbarium.

Wright's specimen bears an annotation, "*Rajania linearis* (Griseb.) Uline det. Uline." In Knuth's monograph of the Dioscoreaceae (Pflanzenreich IV.43: 168. 1924) this Wright number is divided. One pistillate portion is cited as *Dioscorea linearis* Griseb. and another pistillate specimen is referred to *Rajania microphylla* Knuth. The species of *Rajania*, however, is typified by staminate material collected by Poeppig, and no description of the cited pistillate specimen is given. I have not seen the Poeppig specimen nor any fragments of the Wright material that could possibly be referred to the description of that staminate plant.

The specimen of Wright 3254 at the Gray Herbarium consists of a shoot with a series of female flowers and young fruits attached. These are definitely *Rajania* fruits, having one carpel developed into a wing, with the styler portions asymmetrically placed. On the same sheet are two infructescences bearing fruits that are *Dioscorea* fruits and which have been annotated by Uline as *D. tamoides* Griseb. These agree with the description given by Knuth for the fruits of *D. linearis*.

The specimen selected by Knuth as the type of *D. linearis* was in the



Berlin herbarium and is presumably destroyed. It seems necessary to conclude that his description of mature fruits of *D. linearis* was based on the unattached fragments of this Wright collection, which are fruits of *D. tamoidea* Griseb., as Uline noted.

The pistillate inflorescence of *Rajania linearis* is short and bears few flowers. Mature inflorescences of the specimen on hand are 1–1.5 cm. long and bear 3–5 flowers, of which 2 or 3 mature on the average. The one-winged samaras are smaller than those of the majority of species, being about 4–5 mm. wide and 8–10 mm. long. A solitary small seed is developed.

*Dioscorea nipensis* sp. nov. (Sect. *Lychnostemon* Uline). PLATE II, FIG. 1.

Planta volubilis, 4–6 m. alta, glabra; caulibus 1 mm. crassis, striatis; foliis 8–10 cm. inter se remotis, alternis; petiolis teretibus 3 cm. longis; laminis circumscriptione angusto-ovatis, veriter elongato-triquetris, 6–7 cm. longis, 2.5–3 cm. latis, apice attenuatis, basi rotundatis, sinu nullo, auriculis rotundatis; nervis 5, arcuatis; inflorescentiis ♂ 23–27 cm. longis, spicatis, floribus in capitulis dispositis, 2–4-glomerulatis, glomerulis 0.5–1 cm. inter se remotiusculis, bracteis 0.7 mm. longis, lanceolatis, perianthio 1.5 mm. diametro, lobis ovatis; staminibus fertilibus 3, usque 0.7 mm. longis, filamentis carnosius, antheris oblongis, thecis late distinctis, extrorse dehiscentibus; antheris sterilibus 3, usque 0.4 mm. longis, quam fertilibus brevioribus, perianthii lobis interioribus oppositis, antheris apice acutis, basi hastatis; rudimento styli 3-lobato.

ORIENTE: 15 km. southwest of Compania de Moa mill, Moa, in flower July 25, 1941, Howard 5873 (GH, TYPE).

This species is similar to *D. tamoidea* Griseb. It may be distinguished from that species by the leaves, which have rounded bases without sinuses, and by the longer narrow blades.

Like those of most specimens of *Dioscorea*, the leaves turn black on drying. The outer pair of lateral veins frequently fork very close to the base.

*Rajania tenella* sp. nov. PLATE II, FIG. 2.

Planta volubilis glabra; petiolis teretibus, gracilibus, 1.5–2 cm. longis; laminis elongato-triquetris, 5.5–7 cm. longis, 3.3–4 cm. latis, apice attenuatis, basi truncatis, sinu nullo, lobis obtusis, exs. papyraceis, nervis 3, medio a lateralibus parum distincto, lateralibus arcuatis margine confluentibus; inflorescentiis solitariis vel binis axillaribus, 2.5–4 cm. longis, leviter flexuosis, cymis lateralibus 3–4 mm. longis, 4–9-floris, floribus minutis, perianthio 1 mm. diametro, lobis 0.4–0.5 mm. longis, staminibus 6, usque 0.2 mm. longis, introrse dehiscentibus; rudimento styli subnullo.

ORIENTE: Sierra de Nipe south of Woodfred, in dense woods, with yellow flowers, July 28–29, 1941, Howard 6134 (GH, TYPE).

*Rajania tenella* is similar to *R. theresensis* Uline and *R. prestoniensis* Knuth, which I know only from the descriptions. It differs from *R. prestoniensis* in the shape of the blade, the mature leaves being without sinuses and attenuate rather than mucronate. It is unlike *R. theresensis* in having the leaves 3-nerved, the inflorescence much shorter than the

leaves, and the flowers smaller. It is easily distinguished from *R. nipensis* by the truncate base of the mature leaves.

Considerable variation occurs between the juvenile leaves and the mature leaves in most species of *Rajania* (Plate II, fig. 2). For example, the juvenile leaves of the present species are elongate-ovate with the basal lobes more or less developed. The laminae are 2.5–3 cm. long and 0.3–1 cm. wide. There are 3 primary veins, with the lateral veins arcuate. The apex is long-attenuate and the base is truncate or rounded. The petioles are terete and from 0.6–1.2 cm. long.

Because of this variation with age, care must be taken to collect and describe only mature specimens. Frequently the basal portion of a vine may be mature, but near the apex long axillary shoots, perhaps 4–9 feet long, may appear with only juvenile leaves. It is very easy to snatch immature material when such plants grow commonly in dense thickets.

*Platygyne volubilis* sp. nov. PLATE II, FIGS. 3–5.

Frutex monoicus scandens; ramis molliter ferrugineo-pubescentibus; foliis alternis, petiolatis (petiolis teretibus 4–6 mm. longis ferrugineo-pubescentibus) stipulatis ovatis, pubescentibus; laminis obovatis vel oblanceolatis, 5–6.5 cm. longis, 1.5–2.5 cm. latis, rigide membranaceis, basi cuneatis, apice acutis vel rotundatis, margine sinuatis, sparse dentatis, supra et margine urenti-pilosis, subtus sparse hispidis, nervis lateralibus 5, arcuatis, anastomosantibus; inflorescentiis foliis oppositis, ♂ racemosis, ramis usque 3–4 mm. longis, 3–5-floris, pedicellis 4–5 mm. longis; sepalis 4, usque 3.5 mm. longis, triangularibus vel lanceolato-ovatis, reflexis, extus dense strigosis, intus sparse strigosis; corollis nullis; staminibus 5–8, filamentis crassis, usque 1.5 mm. longis; rudimento pistilli nullo; inflorescentiis ♀ glomeratis vel breviter racemosis, ramis ad 2 mm. longis 3–5-floris, pedicellis brevibus, 2 mm. longis; perianthiis 6–9-lobatis, lobis variabilibus, lanceolatis vel ovato-oblongis, 4–5 mm. longis, urenti-ciliatis, extus strigosis; staminium rudimentis nullis; stylis 3, usque 5 mm. longis, oblongis apice bifidis carnosus, ferrugineo-strigosis; ovario globoso trilobato, sparse urenti-piloso; fructu tricocco 5 mm. longo, apice sparse piloso, pedunculo usque 4 mm. longo; columella 3 mm. alta; seminibus rotundis, 3 mm. diametro.

ORIENTE: 20 km. west of Moa, in open pine woods, in flower and fruit, July 26, 1941, Howard 5961 (GH, TYPE).

Most of the plants of *Platygyne* that I had seen growing in the central and western provinces of Cuba had been low shrubs, semi-scrambling over low bushes and in fence rows. It was quite a surprise, therefore, to find in the pine woods west of Moa a specimen of *Platygyne* climbing in the branches of the tall pine trees. The specimen also had distinctive obovate leaves with cuneate bases, short inflorescences, and the fruits were almost without the stinging hairs so common in the only other species of *Platygyne* recognized at present, *P. hexandra* (Jacq.) Muell. Arg.

The indument in specimens of *Platygyne* is of interest because of the several types of hairs found on different parts of the plant. Of most interest to the collector are the short white stinging hairs found only on the leaves, perianth, and on the mature fruits of *P. hexandra*. This is quite

in contrast to the other common "ortiga" of Cuba, *Tragia* spp., in which stinging hairs are abundant on the stems as well as the leaves and inflorescences. In *Platygyne volubilis* the stinging pubescence is found only on the upper surface of the leaves and along the margins as cilia. The hairs on the surface of the leaf are usually single, while the ciliate margin consists of clusters of hairs. The pistillate perianth also has a ciliate margin of stinging hairs, but this is lacking on the staminate perianth. Finally, the fruits of *P. hexandra* are usually densely covered with the white pubescence of stinging hairs. In contrast the fruits of *P. volubilis* have only a few, if any, apical stinging hairs, and the rest of the capsule is covered with a very short ferrugineous indument.

The pubescence on the rest of the plant, including the perianth, staminal disk, and styles, consists of ferrugineous short pointed stiff hairs, best described as strigose.

The pistillate perianth is extremely variable. Baillon, Euphor. 453. 1858, believed the perianth consisted of two whorls, while Mueller, in DC. Prodr. 15: 913. 1864, called them all calyx-segments of one whorl. The outer segments are usually linear-lanceolate and uniform. The inner segments vary greatly in size and shape and are frequently fused and 3-4-lobed at the apex.

The seeds are 3 mm. in diameter and almost spheroid. Mature seeds of *P. volubilis* are gray and are lightly mottled with a dark brown color. The seeds of *P. hexandra* in all the fruiting specimens I have seen are tan, mottled with dark brown. The seeds of *Platygyne* do not have an aril, although a linear protuberance or hilum is present for about one-third the circumference of the seed.

*Phyllanthus chryseus* sp. nov.

Frutex parvus monoicus; ramis paenultimis teretibus robustis usque 5 mm. crassis; bracteis late triangularibus, apice acuminatis, 3 mm. longis, 2.5-3 mm. latis, castaneis, nitidis; ramulis foliigeris 20-28 cm. longis teretibus, 2 mm. crassis, 16-26-phyllis; stipulis minutis usque 1 mm. longis, triangularibus vel lanceolato-subulatis; foliis distichis, petiolis 2.5-3 mm. longis, laminis orbicularibus, basi rotundatis, apice rotundatis vel emarginatis, 2.5-3.5 cm. diametro, crasse coriaceis, chryseis exsiccate viridibus, nervis lateralibus inconspicuis, marginibus revolutis; floribus ♂ axillaribus 1-2, pedicellis 3 mm. longis; sepalis 4, late ovatis vel oblongis, 3.5 mm. longis, 5 mm. latis, carnosus, staminibus coalescentibus vel 1 mm. longis, sporangiis 4, antheris late ovatis, 0.7 mm. longis, extrorse et transverse dehiscentibus; floribus ♀ solitariis axillaribus, pedicellis 1.3 cm. longis, sepalis 4, ellipticis, 5 mm. latis, 4 mm. longis, apice rotundis; disco obscuro, ovario 5 mm. longo, stylis 3, fimbriato-laceratis, 4-9 partitis; fructibus triloccis usque 5 mm. longis; seminibus oblongis, hebeti-nigris, profunde et crasse reticulatis, 4 mm. longis.

ORIENTE: 2' shrub, common in woods along ravine 15 km. southwest of Moa, leaves golden color, in flower and fruit July 26, 1941, Howard 5829 (GH, TYPE); Moa, Bucher 75 (NY); Río Cabanas, Moa, May 27-31, 1943, Marie-Victorin & Clement 21755 (A).

This was a very striking plant in the field, for the brilliant golden leaves



were in contrast with the red iron soil on which it was growing. On drying the leaves turn light green above and pale brown beneath. This species is distinct from others in the *Orbicularia* section of *Phyllanthus* by its large orbicular leaves, which are numerous for their size. The bright golden color and strongly revolute margins of the leaves, the small stipules, and the short triangular bracts distinguish this species from others of the *P. cinctus* group as established by Carabia, in *Ecological Monographs* 15: 331. 1945.

In gross appearance *Phyllanthus chryseus* appears similar to *P. sub-carnosus* Griseb., which is based on fragmentary material. An isotype of the latter species at the Gray Herbarium has a single fruit with unusually heavy capsules for *Phyllanthus*, and the seeds are smooth and brown. The dull black, coarsely and deeply reticulated seeds of the present species are distinct from any I have seen in this genus, but so few seeds have been described that I can not evaluate this character.

*Eugenia moaensis* sp. nov.

Frutex glaber; ramis hornotinis teretibus vel subcompressis, ferrugineis; petiolis 2–4 mm. longis, 1.5 mm. crassis, sulcatis; laminis lanceolato-ovatis vel ellipticis, 5.5–6.5 cm. longis, 2–2.5 cm. latis, basi et apice acutis, apice emarginatis, coriaceis, nervo medio supra leviter impresso, subtus prominente, nervis lateralibus anastomosantibus, margine revoluti; inflorescentiis axillaribus, pedicellis solitariis vel 2–3-fasciculatis, 6–10 mm. longis, bracteis minutis, 2, ciliatis; calycis lobis 4, ovatis, 2 mm. longis et latis, ciliatis; petalis 4, oblongis, 4 mm. longis, 1–1.2 mm. latis, ciliatis; staminibus numerosis 2 mm. longis; stylo 3 mm. longo; ovario 3-loculato, ovulis numeroso; baccis 5–7 mm. diametro, pericarpio crasso succulento, dense glanduloso; seminibus 1 vel 2, rotundatis vel subreniformibus 3–5 mm. longis, testa brunnea membranacea nitida.

ORIENTE: 7' shrub, flowers yellow, fruits green, along creek bank at Moa, *Howard 5866* (GH, TYPE).

The leaves of the present species are thick and coriaceous. The upper surface is shiny when dry and darker in color than the lower surface. Punctate glands are present in the lamina but are well hidden in the tissues of the leaf. Approximately 6 strong lateral veins are revealed on the upper leaf-surface, and these anastomose near the margin. The veins are obscure below.

*Eugenia moaensis* appears to be similar to *E. (?) Ossacana* Urb., which was described on very incomplete material collected by Shafer in the same locality as the present specimen. It is different in being completely glabrous, except for a ciliate perianth, and the venation of the leaves does not agree with the description as given by Urban. The pedicels of the present species are much longer than those of *E. (?) cupuligera* Urb., to which this plant is also similar. *Eugenia moaensis* may also be related to *E. cristalensis* Urb.; however, it differs from this in the leaf-characters and the leaf-size.

*Calyptanthus oblongifolia* sp. nov.

Frutex; ramis hornotinis compressis, sub interstitiis foliorum plus

minusve sulcatis, pilis dibrachiatis adpressis ferrugineis vel pallescentibus vestitis, annotinis glabrescentibus teretibus vel lineato-striatis, dichotomis; petiolis 4–5 mm. longis subteretibus supra sulcatis; laminis oblongis vel oblongo-lanceolatis, 4.5–7 cm. longis, 1.5–2 cm. latis, basi rotundatis, antice acutis vel rotundatis, nervo medio supra per totam longitudinem anguste impresso, nervis lateralibus ca. 15 inconspicuis; inflorescentiis ad basin ramorum hornotinorum binis, subcapitatis; pedunculis 2–4, 2–5 mm. longis, capitulis 3–5-floris; baccis nigro-purpurascens, depresso sphaeroideis, 5–7 mm. diametro, loculis 2; seminibus reniformibus 2 in quoque loculo, 3 mm. longis.

ORIENTE: Along south coast of Bahia de Moa near Moa, 4' shrub, fruits green becoming purple on maturity, *Howard 5948* (GH, TYPE).

*Calyptranthes oblongifolia* is characterized by the oblong or lanceolate-oblong leaves and the few-flowered, very short peduncles of the seemingly capitate, axillary inflorescence. In general appearance this species is similar to *C. rupicola* Urb. and *C. heterochroa* Urb.

The occurrence of malpighiaceae or two-armed hairs on the plant is characteristic of several species of *Calyptranthes*. In the present species these hairs are very dense on the young leaves, the stems, peduncles, flowers and fruits, giving the appearance of a ferrugineous tomentum. In the older leaves the hairs are broken off even with the epidermis and leave the sunken hair-bases commonly found in the other species and which frequently seem to be mistaken for epidermal glands. The upper surface of the mature leaves of *C. oblongifolia* is glabrous except for the impressed midrib, while the hairs on the lower surface persist. These hairs usually remain ferrugineous in color, although many turn gray or white.

The inflorescence consists of short axillary peduncles with a very few flowers and appears to be capitate. The bracts subtending the flowers are minute and fall away very early, none appearing in the mature infructescences. The flowers had matured on the specimens studied, but several young fruits still possessed 3 or 4 stamens attached to the hypanthium at the line of dehiscence of the calyptra. The style was 2 mm. long and bifid at the apex. The calyptra was conical and about 1.2 mm. in diameter.

The drupes are a dark purple color when fresh, drying black or brown. Because of the dense pubescence, many appear to be silvery in reflected light. There are 2 cells to the ovary, each containing 2 seeds. The seeds are reniform and tan on the convex surface and black or dark brown on the sides and in the concave surface. The embryo is curved.

*Psidium confertum* sp. nov.

Frutex vel arbor parva; ramis hornotinis plus minusve compressis tenuibus vix 1.5 mm. latis, tomentosis, pilis crispis, vetustioribus ferrugineis; petiolis 2–2.5 mm. longis, laminis ovatis vel ellipticis, 2–2.8 cm. longis, 1.4–1.6 cm. latis, basi rotundatis, apice rotundis vel parce emarginatis, margine recurvo, nervo medio supra impresso, subtus prominente, nervis lateralibus obsoletis; cymis axillaribus dense tomentosis, 3–5-floris, rhachi 4–6 mm. longa, pedunculis 0.8–1.1 cm. longis; calycibus 4-lobatis, leviter imbricatis, tomentosis, lobis ovatis 1–2 mm. longis; petalis 4 vel 5, ovatis,

extus sparse pubescentibus, dense glandulosis; staminibus numerosis; stylis 2 mm. longis; ovario 2-loculari, ovulis in quoque loculo ca. 10; seminibus reniformibus 2 mm. longis; fructibus immaturis, stylis usque 9 mm. longis.

ORIENTE: Wet hillside near the airfield at Moa, 12' shrub collected in flower and young fruit July 26, 1941, *Howard 5901* (GH, TYPE).

*Psidium confertum* is characterized by the small ovate to elliptic leaves, the persistent ferrugineous tomentum, the cymose inflorescence, and the 2-celled ovary. In these characters it differs from *P. bullatum* Brit., *P. ophiticola* Brit. & Wils., and *P. leiophloeum* Urb., to which it is related.

The species is named for the crowded condition of the flowering shoots. The internodes are from 1–1.5 cm. long with the leaves opposite or in whorls of three at the nodes. The compact inflorescence adds to the density of the shoots.

The leaves are densely glandular; however, the glands are hidden by the persistent tomentum on the lower surface and are not visible from the dorsal surface. The very young leaves are densely pubescent on both surfaces. The lower surface remains persistently pubescent, while the upper surface is glabrous and becomes a bright yellow-green color on maturity.

Two small bracts subtend the flower. The buds are globose above the ovary. Mature fruits are 5–6 mm. in diameter, and the numerous seeds are reniform, about 2 mm. long. On the concave surface of each seed extending over the sides are areas which are dark brown to black in color. The remaining surface of the seed is a yellow-brown. The embryo is only slightly curved.

*Eugenia Sturrockii* sp. nov.

Arbor parva vel frutex, glaber; ramis hornotinis compressis, sub interstitiis foliorum plus minusve sulcatis; petiolis 3–4 mm. longis, subteretibus supra sulcatis; laminis anguste lanceolatis 4.5–5 cm. longis, 0.8–1 cm. latis, basi et apice acuminatis, coriaceis glabris, supra nitidis, marginibus revolutis, nervis lateralibus inconspicuis; inflorescentiis axillaribus, racemosis, racemis usque 2 mm. longis, bracteis ovato-lanceolatis, minutis; 4–5-floris, pedunculis 5–7 mm. longis; sepalis 4, ovatis, usque 1 mm. longis, glabris; petalis non visis; staminibus numerosis, subaequalibus; stylo 2 mm. longo; baccis 4 mm. diametro, loculis 2, seminibus reniformibus vel ovalibus, 1 in quoque loculo, 2.5 mm. longis, testa membranacea, levi, brunnea, nitida.

ORIENTE: 8' shrub or small tree in dense woods of ravine, 15 km. southwest of Compania de Moa mill, Moa, collected July 26, 1941, *Howard 6034* (GH, TYPE).

This species is named in honor of Mr. David Sturrock, who was Superintendent of the Atkins Institution of the Arnold Arboretum at Soledad, Cuba, for many years and who was so very helpful in arranging my trip to the Oriente.

This species at first glance is similar in appearance to *E. psiloclada* Urb. However, the leaves of the new species are coriaceous, the veins obscure, the upper surface shiny, and the margin strongly recurved. *Eugenia psiloclada*, by contrast, has thin leaves with veins and glands prominent,



dull surfaces, and perfectly flat margins. The leaves of *E. Sturrockii* have the characteristic glands, but these are buried in the leaf-tissue and are visible only when the leaf is held to the light.

Several of the fruits examined had only one mature seed. Closer examination revealed an aborted cell and ovule at the apex of the fruit. The flowers are articulated to the pedicel, the fruits dehisce at this point very readily, and the peduncles persist even on the old shoots.

*Neobraccia Howardii* Woodson, sp. nov.

Frutex ramosus ca. 2 m. altus, ramis teretibus cortice luteo, ramulis puberulis tandem glabrat. Folia opposita petiolata, lamina late elliptica apice obtusa basi latiuscule acuta 4–7 cm. longa 2–3.5 cm. lata firmiter membranacea supra nitidula subtus dense puberula, petiolo 0.4–0.8 cm. longo puberulo. Inflorescentia racemosa subcorymbiformis terminalis vel subterminalis pluriflora, pedunculo tenui ca. 3–4 cm. longo puberulo, pedicellis ca. 0.5 cm. longis puberulis, bracteis lineari-oblongeolatis usque 0.5 cm. longis subfoliaceis. Flores albi, calycis laciniis anguste lanceolatis acuminatis 0.5 cm. longis subfoliaceis ut in pedicello vestitis intus in sinibus 0–2-glandulosis, corollae subinfundibuliformis tubo ca. 0.9 cm. longo basi ca. 0.1 cm. diam. faucibus usque 0.25 cm. diam. ampliatis extus sparse irregulariterque pilosulo intus prope basim staminifero, lobis late oblongo-dolabriformibus ca. 0.8 cm. longis. Antherae subsessiles lineari-lanceolatae basi anguste sagittatae ca. 0.3 cm. longae dorso dense puberulae. Ovaria oblongoidea glabra ca. 0.15 cm. longa, nectaria 5 compresse subquadrata ca. 0.05 cm. longa, stylo crassiusculo ca. 0.2 cm. longo, stigmate capitato 5-maniculato ca. 0.05 cm. longo apice papillato. Folliculi immaturi tenues remote moniliformes.

LAS VILLAS: Limestone Loma Ventana, Trinidad Mountains, San Blas–Buenos Aires, Aug., 1941, *Howard 6495* (Herb. Missouri Bot. Gard., TYPE).

This species is very well marked by its abundant pubescence and broad, elliptic foliage, as well as the several-flowered inflorescence.

Since the publication of my revision of *Neobraccia* (in Ann. Missouri Bot. Gard. 23: 169. 1936), I have examined a flowering specimen of *N. Ekmanii* Urb., the type and heretofore the only known specimen of which was in fruit, and that apparently mislaid when I visited the herbarium at Dahlem in 1930. The flowering specimen was collected by Mrs. G. C. Bucher during the summer of 1939 near Moa, Oriente, Cuba. The corolla, apparently pink, is very broadly infundibuliform, the proper tube 6 mm. long, 1 mm. in diameter at the orifice, the lobes 10 mm. long. The calyx-lobes are linear-lanceolate, 2 mm. long.

*Bonnetia cubensis* (Brit.) comb. nov.

*Kieseria cubensis* Brit. in Bull. Torr. Bot. Club 41: 19. 1914.

*Bonnetia* Mart. & Zucc. has been conserved (Kew Bull. 1940: 113. 1940) and *Kieseria* Nees has been rejected. A new combination is needed for this Cuban species.

The species is apparently endemic along the coast of Bahia de Moa on serpentine soil. The type collection was made in 1914 and only two more recent collections are known, *Howard 5842*, a 15' tree with pink flowers

collected July 26, 1941, in dense woods 15 km. southwest of Compania de Moa mill, and *Marie-Victorin, Clement & Alain 21436*, collected in flower April 1943 at the mouth of the Punta Gorda River at Moa.

*Buxus flaviramea* (Brit.) comb. nov.

*Tricera flaviramea* Brit. in Bull. Torr. Bot. Club 42: 499. 1915.

A second record of this species is *Howard 5100*, collected June 15, 1941, in open grassy savannah 10 km. west of Santa Clara city, Las Villas Prov.

*Xyris Jupicai* Rich. in Act. Soc. Hist. Nat. Paris 1: 106. 1792.

This is a very widely distributed species through the Antilles, but the present collection (*Howard 6011*, in flower, July 26, 1941, airfield at Moa, Oriente) is of interest since it is the first representative of the genus known to me from the Oriente. The many species of *Xyris* in Cuba are centered in Pinar del Rio province, with two species reaching the Cienaga swamps in southwestern Las Villas province. The present collection consists of larger and more tuberculate plants than the average, but the specimens still fit within the limits of the species as defined by Malme in N. Am. Fl. 19: 11. 1937.

*Cassia clarensis* (Brit.) comb. nov.

*Chamaecrista clarensis* Brit. in N. Am. Fl. 23: 278. 1930.

*Cassia insularis* (Brit. & Rose) comb. nov.

*Chamaefistula insularis* Brit. & Rose, in N. Am. Fl. 23: 239. 1930.

In addition to those from the type localities, specimens of these two species are known from the Castillo de Jagua and the coast of Cienfuegos Bay.

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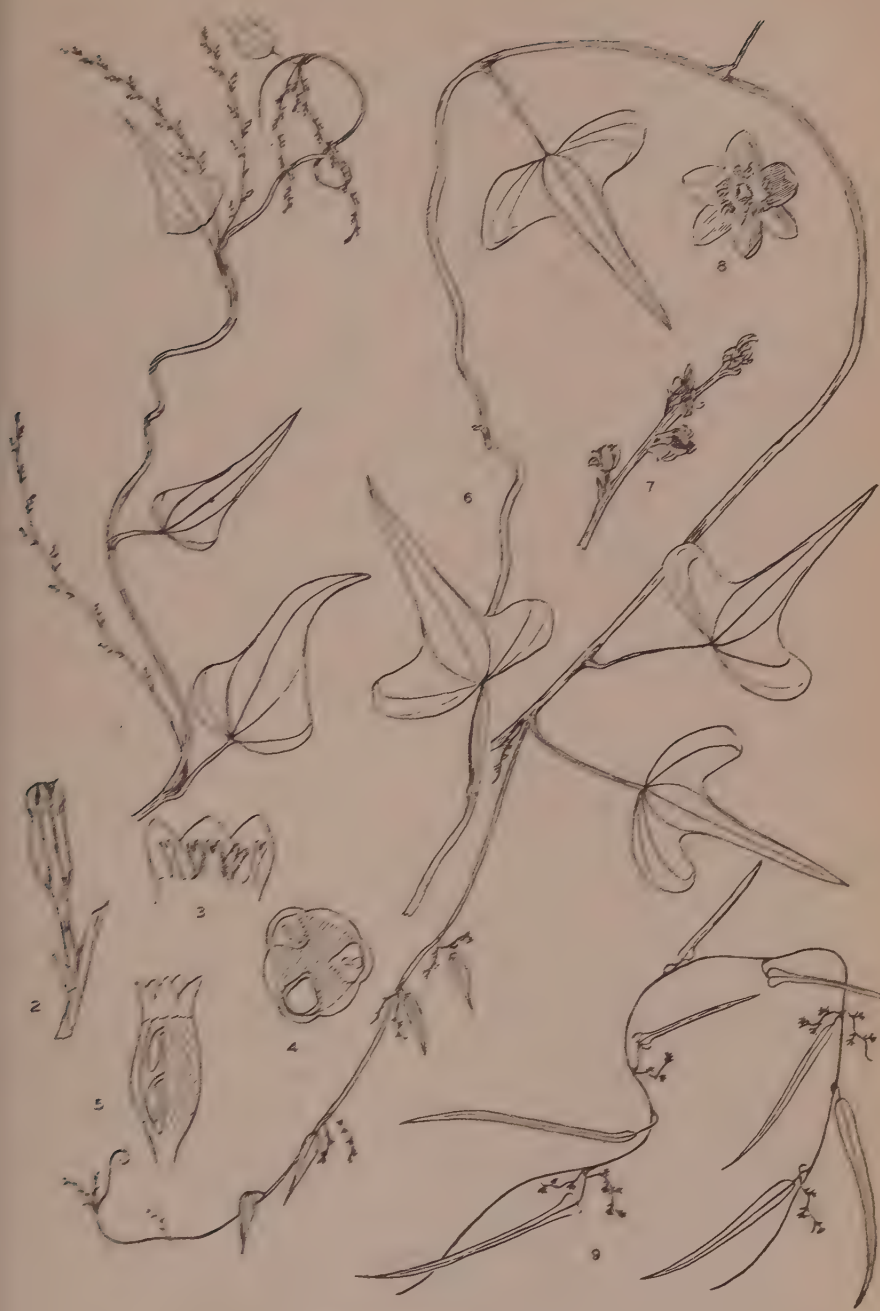
## EXPLANATION OF PLATES

### PLATE I

FIGS. 1-8. *Rajania nipensis* Howard (*Howard 6136a*): 1. habit, ♀ × ½; 2. single flower from portion of ♀ inflorescence, × 6; 3. portion of ♀ flower showing the 3 bifid styles and 2 of the bifid staminodes, × 15; 4. cross-section of the ovary showing the six lobes and the 3 locules, one of which has fertile ovules, × 15; 5. sagittal section of flower showing two superposed fertile ovules, × 8; 6. habit, ♂ × ½; 7. portion of ♂ inflorescence, × 3; 8. ♂ flower showing pistil-rudiment and 6 introrse fertile stamens, × 15. FIG. 9. *Rajania linearis* (Griseb.) Howard (*Howard 6096*): habit, × ½.

### PLATE II

FIG. 1. *Dioscorea nipensis* Howard (*Howard 5873*): habit, × ½. FIG. 2. *Rajania tenella* Howard (*Howard 6134*): habit, × ½. FIGS. 3-5. *Platygyne volubilis* Howard (*Howard 5961*): 3. habit, × ½; 4. dorsal view of fruit, × 1.5; 5. lateral view of fruit, × 1.5.



SOME PLANTS OF CUBA







SOME PLANTS OF CUBA





## RELATIONSHIP AND TAXONOMY OF THE GENUS BRANDISIA

HUI-LIN LI

THE GENUS *Brandisia* is confined to the warmer parts of continental eastern Asia from eastern India, Burma, and Indo-China to southwestern and southern China. It has been included in the Scrophulariaceae, usually in the tribe Cheloneae, together with other anomalous genera like *Paulownia* and *Wightia*. Its taxonomic position has been doubted ever since it was first described, but no extensive and intensive studies have ever been made on the genus.

The following study, based on the Chinese species of the genus, is made on materials assembled from various herbaria in America. To the curators of these herbaria I am indebted for their kindness in furnishing material for the study. This study was made at the Academy of Natural Sciences of Philadelphia during the tenure of a Harrison Fellowship for Research of the University of Pennsylvania. To Mr. Charles M. B. Cadwalader, President of the Academy, I wish to express my thanks for permitting me access to the splendid library and herbarium facilities. To Dr. Francis W. Pennell, Curator of Plants, my thanks are due for his suggestions and his kindness in reading the manuscript.

Abbreviations for the various herbaria cited are as follows:

- AA Arnold Arboretum of Harvard University
- ANSP Academy of Natural Sciences of Philadelphia
- B Bonati Herbarium, to be deposited at the herbarium of the University of California at Los Angeles
- MBG Missouri Botanical Garden
- NYBG New York Botanical Garden
- RBGE Royal Botanic Gardens, Edinburgh
- UC University of California
- USNH United States National Herbarium

## RELATIONSHIP

The tribe Cheloneae of the Scrophulariaceae is very artificial and heterogenous. To this tribe have been referred several of the woody genera of various localities, while the family Scrophulariaceae as a whole is herbaceous. The anomalous positions of *Paulownia* and *Wightia* have been questioned by some authors. Hallier (in Bull. Herb. Boiss. II. 3: 181-207. 1903), in making a review of the taxonomic relationships of the various genera of the Scrophulariaceae, concluded that these two genera should be assigned to the Bignoniaceae. Campbell (in Bull. Torrey Bot. Club 57: 47-50. 1930) reached the same conclusion for *Paulownia*. He

indicated that the small amount of endosperm present in the seed is not sufficient reason to exclude it from the Bignoniaceae, with which it agrees in many other characters. Hallier, however, still considered *Brandisia* as belonging to the Cheloneae and evidently had not made any special study of the genus.

When Hooker and Thomson first described the genus no fruiting material was available. They noted the general appearance of the plant to be very different from the Scrophulariaceae, and rather verbenaceous. However, they placed it in the Scrophulariaceae because of the many-ovuled capsule. They remarked: "The order can, in fact, only be approximately determined, as the dehiscence of the fruit and the structure of the seed are unknown. If the seeds be exalbuminous, it will go to Bignoniaceae; but the ovary and placentation are so much like Scrophulariaceae, that in all probability albumen will be found in the seeds."

With regard to its position in the Scrophulariaceae, they said: "The position of *Brandisia* among Scrophularineae, as Mr. Bentham has kindly pointed out, is probably among Cheloneae, the only tribe in which large woody climbing plants occur. The flowers though solitary, have two opposite bracteoles on the pedicel, and the curiously elongate ovules probably become winged seeds like those of *Wightia*." In the *Genera Plantarum*, the fruits and seeds were described and the genus was placed in the tribe Cheloneae together with *Wightia* and *Paulownia*. This has been followed subsequently by other authors.

In 1873, Kurz (in *Jour. As. Soc. Beng.* 42(2): 39-141, 1874), in listing *Brandisia discolor* for the Burmese flora, considered the status of the genus and made the following statement: "*Wightia*, Wall., arcte affinis. Etiam *Buddleiae* generi affinis, sed differt corolla irregulari, etc. et certissime inter *Sesameas* recipienda est. *Gardneria*, a cl. Benthamico *Loganiaceis* adnumerata, *Solanea* esse videtur." He placed the genus under "Pedalineae." In 1877 Kurz (*For. Fl. Brit. Burma*) listed *Gelsemium* and *Buddleia* under "Pedalineae," in addition to *Brandisia*. Both these genera belong to the Loganiaceae.

Hance (in *Jour. Bot.* 18: 299, 1880) mentioned that *Brandisia* "has a curious resemblance to the genus *Eremophila*, in *Myoporaceae*." This is an Australian genus. The *Myoporaceae* is a small family, with the genus *Myoporum* extending from the tropics of the Old World to India and eastern Asia.

Thus we have suggested relationship for the genus *Brandisia* to the following families: Loganiaceae, Solanaceae, Scrophulariaceae, Bignoniaceae, Pedaliaceae, Myoporaceae, and Verbenaceae.

Being strongly zygomorphic in its corolla, *Brandisia* cannot be associated with either Loganiaceae or Solanaceae, in which the corolla is actinomorphic. The place of the genus is evidently with the other families which have distinct zygomorphy. In spite of the general resemblance of the plant in appearance to some genera of the *Myoporaceae* and the *Verbenaceae*, its many-ovuled ovaries and capsular fruits will not permit it to be included

in either of these two. Being a shrubby genus and without staminodes, it is not referable to the Pedaliaceae.

The families Scrophulariaceae, Bignoniaceae, Gesneriaceae, and Orobanchaceae are closely related and it is sometimes difficult to draw sharp distinctions between them. The Gesneriaceae and Orobanchaceae are predominantly herbaceous families, with unilocular ovaries, the latter being also parasitic. The choice for placing *Brandisia* is therefore left to the Scrophulariaceae and the Bignoniaceae.

The Bignoniaceae are nearly all woody plants, many of them climbers. The Scrophulariaceae are predominantly herbaceous. The chief distinction between the two families is the presence of endosperm in the seeds in the Scrophulariaceae and the absence of the same in the Bignoniaceae. The fruit of the Scrophulariaceae is usually a capsule or sometimes a berry. The seeds are usually numerous and small. In the Bignoniaceae, the fruit is most often a two-valved capsule, usually very long and silique-like. The seeds are numerous, large, flattened, and membranaceous-winged.

In the Scrophulariaceae, the tribe Cheloneae is one of the few that contains woody genera. In this tribe, which is artificial and ill-defined, there have been included some anomalous genera including *Paulownia*, *Wightia*, and *Brandisia*. *Paulownia* has been included in this family instead of the Bignoniaceae because of the presence of endosperm in the seeds. Hallier (l. c.) has shown that endosperm is only scantily present in *Paulownia* and is absent in *Wightia*, and that the seeds of both are winged. He concluded that both genera, in which all species are trees, should be transferred to the Bignoniaceae.

The ovoid loculicidal capsular fruit of *Brandisia* is very similar to those of the Scrophulariaceae, but the seeds, although very small, are winged and are without endosperm. They are small, numerous, linear, with an elongated membranaceous winged testa which is reticulated. The fruit of *Wightia* is an oblong or ovoid capsule, but is septicidal, and the seeds are membranaceous and broadly winged all around. The fruit of *Paulownia* is a woody capsule, loculicidally dehiscent, with numerous small winged seeds.

There is an apparent relationship between the three genera mentioned. The transference of *Paulownia* and *Wightia* to the Bignoniaceae, although they still appear somewhat anomalous in that family, seems to be a better arrangement than to have retained them in the Scrophulariaceae. *Brandisia*, although seeming even more isolated if placed in the Bignoniaceae, certainly should be associated with *Wightia*, whatever the latter's disposition. Here we have a situation in which there must be additional knowledge in anatomy, pollen structure, cytology, etc., before a satisfactory disposition can be made of these genera as to their taxonomic position, as well as delimitation of the various families concerned.

#### DISTRIBUTION

To the eight species recognized in this study, there should be added

three more from Annam, described by Bonati, of which no material is available. The genus ranges from Assam (India) and southern Burma to western China, north to western Hupeh, and southern China, east to Kwangtung. It is also found in Annam, Indo-China. So far it has not been recorded from Formosa, Hainan, or Tonkin.

The species are found mostly on mountains up to an altitude of 3000 meters, those in the south ascending usually to higher levels than those in the north. Most of the species are local in distribution and rare in occurrence. The most common and most widely distributed species is *Brandisia Hancei*, which is found in Yunnan, Szechuan, Hupeh, Kweichow, and Kwangsi. *Brandisia rosea* is found in northwestern Yunnan, Assam, and Bhutan. *Brandisia discolor* is found in southern Burma and southern Yunnan. *Brandisia Swinglei* occurs in Kwangtung and eastern Kwangsi, while *B. kwangsiensis* is known only from Kwangsi; the two species *B. laetevirens* and *B. glabrescens* are confined to southern Yunnan. *Brandisia racemosa* is found in Yunnan from the south to the northeast. Three species, *B. Chevalieri*, *B. annamitica*, and *B. scandens*, are known from Annam only.

The genus is primarily of the subtropical regions of eastern continental Asia, particularly of the mountains at medium levels. The center of distribution is apparently in Yunnan, where six of the eleven species occur. Only two, *B. Hancei* and *B. rosea*, occur in the Sino-Himalayan region in northwestern Yunnan, and these are not endemic. More species, although mostly of rather limited distribution, are found in the warmer regions of the province in the south as well as in the east.

#### TAXONOMY

*Brandisia* Hooker f. & Thomson in Jour. Linn. Soc. Bot. 8: 11. 1865.

Shrubs, erect, scandent, or straggling, sometimes parasitic, often with stellate tomentum; leaves opposite or rarely subopposite, oblong-lanceolate to ovate, entire to slightly serrate, usually densely tomentose especially below, short-petiolate; flowers axillary, solitary or rarely in pairs, sometimes several together or short- or long-racemose, pedicellate, the pedicels bibracteolate; calyx campanulate, with or without distinct veins, subequally 5-dentate or sometimes 4-7-dentate, rarely bilobed; corolla infundibular, bilabiate, usually densely tomentose, the tube usually incurved, the lips spreading, the upper lip larger and longer, concave, 2-lobed, the lobes broad, obtuse, the lower lip shorter, 3-lobed, the lobes smaller, subequal or unequal, acute, attached at the same level or in the middle and much lower; stamens 4, didynamous, ascending, subexserted or included, attached near the base of the corolla-tube; staminodes absent; filaments glabrous; anthers rounded, bilocular, the cells confluent above, long-pilose especially at the tip and the margins; ovary ovoid, hairy, bilocular, many-ovuled; styles elongate, filiform, glabrous, the stigma simple, entire; ovules numerous, linear-oblong; fruits capsular, chartaceous, ovoid, acute, loculicidally dehiscent into 2 valves; seeds small, numerous, linear, with thin winged membranaceous elongated testa, reticulated.

TYPE SPECIES: *B. discolor* Hook. f. & Thoms.



About 11 species, in the subtropical and warmer parts of continental eastern Asia.

With the addition of many other species to the original, it is necessary to redefine the generic concept of the genus and to form three subgenera, of which the last two contain each but a single species. In addition to the eight species recognized for China, India, and Burma, there are three species described by Bonati from Annam, of which no material is available to me. Two of these, *B. Chevalieri* Bonati and *B. scandens* Bonati, evidently belong to *Eubrandisia*. *Brandisia annamitica* Bonati, described as having the flowers in groups of 3-5 and having two staminodes, may require the erection of another subgeneric group.

#### SUBGENERA OF BRANDISIA

##### SUBGENUS I. *Eubrandisia*, subgen. nov.

Frutex erectus vel scandens; foliis oppositis, basi acutis vel cordatis; floribus axillaribus, solitariis vel binis; corolla flava vel rosea, labio antico brevior, lobis subaequalibus; calyce campanulato, plerumque 5-dentato.

##### SUBGENUS II. *Rhodobrandisia*, subgen. nov.

Frutex erectus; foliis oppositis vel suboppositis, basi longe attenuatis; floribus axillaribus, solitariis vel binis; corolla rosea vel raro flava, labio antico fere brevior, lobis subaequalibus; calyce bilobato, lobis integris vel leviter bifidis.

##### SUBGENUS III. *Coccineabotrys*, subgen. nov.

Frutex scandens, parasiticus; foliis oppositis, basi rotundatis; floribus racemosis; corolla rubra, labio antico valde brevior, lobis inaequalibus; calyce campanulato, 5-dentato.

#### KEY TO THE CHINESE SPECIES

- A. Flowers axillary, single, rarely 2 together, scattered throughout the whole length of the stems; calyx usually long-pilose within, sometimes tomentose; lower lip of corolla about as long as or slightly shorter than the upper lip, the lobes subequal and attached at about the same level; capsules densely tomentose to rarely glabrescent.
  - B. Calyx more or less prominently 5-costate, 5-dentate, usually long-pilose within; leaves strictly opposite, the base acute to cordate (SUBGENUS I. *Eubrandisia*).
    - C. Calyx broadly campanulate, about as long as broad, much enlarged above, the teeth divided for  $\frac{1}{3}$  to  $\frac{1}{2}$  the length.
      - D. Leaves subsessile to short-petiolate, the petiole to 4 or 5 mm. long; leaf-bases strongly cordate.....1. *B. Hancei*.
    - DD. Leaves distinctly and slenderly petiolate, the petioles 5 mm. or more long; leaf-bases acute to rounded or subcordate.
    - E. Petioles short, about 5 mm. long; calyx large, 10 mm. long, 8-9 mm. wide.
      - F. Leaves strongly discolored on the two surfaces, the upper dark brown to almost black in the dried state; leaf-bases rounded to subcordate.
        - G. Leaves broadly ovate, to 4 cm. wide and 9 cm. long; indumentum grayish; calyx-teeth long-acute, 7 mm. long. ....2. *B. Swinglei*.
    - GG. Leaves narrowly ovate, to 3 cm. wide and 9 cm. long; indumentum brownish; calyx-teeth short-acute, to 4 mm. long.....3. *B. laetevirens*.

- FF. Leaves subconcolorous on the two surfaces, the upper brownish in the dried state; leaf-bases acute to subrounded. .4. *B. kwangsiensis*.  
 EE. Petioles long, 1 cm. or more in length; calyx small, 6–7 mm. long and wide. ....5. *B. discolor*.  
 CC. Calyx cylindric-campanulate,  $1\frac{1}{2}$  to 2 times as long as wide, narrowed or very slightly expanded above, the teeth divided to about a quarter of the length of the calyx. ....6. *B. glabrescens*.  
 BB. Calyx without prominent nerves, 2-lobed, tomentose to glabrous within, the lobes entire or slightly bifid; leaves opposite to subopposite, the bases long-attenuate (SUBGENUS II. *Rhodobrandisia*).....7. *B. rosea*.  
 AA. Flowers racemose, many together on long or short branches or toward the end of the stems; calyx pubescent within; lower lip of corolla twice or more shorter than the upper lip, the middle lobe smaller than and attached half as low as the lateral ones in a deep notch; capsules glabrous (SUBGENUS III. *Coccineabotrys*). ....8. *B. racemosa*.

1. *Brandisia Hancei* Hook. f., Fl. Brit. Ind. 4: 257. 1884, *in nota*; Forbes & Hemsl. in Jour. Linn. Soc. Bot. 26: 179. 1890; Diels in Bot. Jahrb. 29: 565. 1900; Rehder in Sargent, Pl. Wils. 1: 573. 1913; Limpricht in Rep. Sp. Nov. Beih. 12: 480. 1922; Hu in Jour. Arnold Arb. 5: 233. 1924; Pai in Contr. Inst. Bot. Nat. Acad. Peiping 2: 186. 1934; Hand.-Maz., Symb. Sin. 7: 831. 1936.

*Brandisia discolor* sensu Hance in Jour. Bot. 18: 299. 1880, *non* Hook. f. & Thoms.

HUPEH: No precise localities, *Henry 1009* (NYBG), *3007* (USNH); western Hupeh, *Wilson 147* (NYBG, USNH), *147a* (NYBG); Ichang, *Wilson 2404* (AA, USNH); Liang Sung Kou, *W. Y. Chun 3840* (AA), *4185* (USNH); En-shih District, *H. C. Chow 1885* (AA, USNH); Yangtze Gorges, *N. C. Nelson s. n.* (UC). SZECHUAN: Tchen-keou-tin, *Farges s. n.* (ANSP, B); Mount Omei, *Chiao & Fan 362* (AA), *T. T. Yü 289* (AA); Nan-chuan District, *W. P. Fang 5675* (AA, ANSP, NYBG), *5676* (AA, ANSP, NYBG); Kwang-yun District, *F. T. Wang 22616* (AA); Wanhshien, Yen-ching-kou, *Mrs. W. Granger 3* (UC). YUNNAN: No precise localities, *E. E. Maire 1344* (UC), *Forrest 9370* (AA), *9672* (AA), *T. T. Yü 14812* (AA); Hee-chan-men, *Delavay 1934* (ANSP, B, NYBG); Mo-so-yn, *Delavay 4626* (ANSP, B); Kiao-kia, *F. Ducloux 1237* (UC); Yunnan sen, *F. Ducloux 159* (ANSP), *1027* (NYBG, UC); Siao-ou-long, *E. E. Maire 183* (AA); Pe-yen-tsin, *S. Ten 23* (AA), *34* (AA); Yungpe, *S. Ten 403* (UC); Mengtze, *A. Henry 9013* (AA, ANSP, MBG, NYBG, USNH); between Muang Hing and Szemao, *J. F. Rock 2821* (AA, UC, USNH); between Tengyueh and Likiang, *J. F. Rock 8115* (AA, UC, USNH); Kun-ming, *C. Schneider 55* (AA), *227* (AA), *H. Handel-Mazzetti 13053* (AA), *C. W. Wang 62624* (AA), *62050* (AA), *F. C. How 74244* (AA), *74247* (AA); Tsang-shan, near Tali, *C. Schneider 3246* (AA); Kien-shuei District, *H. T. Tsai 53027* (AA); Likiang, *C. W. Wang 71414* (AA), *K. M. Feng 2547* (AA), *2635* (AA), *R. C. Ching 20073* (AA), *21687* (AA); Hua-ning, *Y. Tsiang & H. Wang 16377* (AA); Monhua, *T. T. Yü 18269* (AA). KWEICHOW: Kiang-kou District, *Steward, Chiao, & Cheo 948* (AA, NYBG, USNH); Ying-kiang District, *Steward, Chiao, & Cheo 895* (USNH), *Y. Tsiang 7795* (NYBG); Chengfeng, *Y. Tsiang 4456* (AA, NYBG, USNH); Tungtze, *Y. Tsiang 4944* (NYBG), *5134* (NYBG, UC); An-lung, *Y. Tsiang 7416* (NYBG, UC), *9321* (NYBG); Chen-lin-shan, Kweiyang, *S. W. Teng 90019* (AA). KWANGSI: Ling-yun District, *Steward & Cheo 49* (AA).

This species was first identified as *Brandisia discolor* Hook f. & Thoms. by Hance. Hooker (l. c.), however, under that Burmese species simply mentioned: "The Chinese plant referred to *B. discolor* by Hance, differs in the broad calyx-lobes and corolla; it is *B. Hancei*, H. f." Hance's type is a Mesney collection from Kweiyang, Kweichow Province. Forbes and Hemsley cited *Henry s. n.* from Hupeh, *Mesney s. n.* from Kweichow, and also *Maire s. n.* and *Bourne s. n.* of unclarified locations. Rehder cited *Henry 1150* and *3007* from western Hupeh, and *Henry 9013* from Mengtze,

Yunnan. He said: "No good description of this species has been published so far, but according to Dr. A. B. Rendle of the British Museum who kindly compared Wilson's No. 3404 with the type of *B. Hancei* Hook. f. from Kweichow, there is no difference between the two specimens. Wilson's specimen also agrees perfectly with Henry's specimen from Hupeh referred by Hemsley to *B. Hancei*. Henry's No. 9013 from Yunnan differs slightly in its smaller and narrower leaves." Hu gave a detailed description for the species but cited no specimens.

*Brandisia Hancei* is apparently a common shrub at medium levels (500–2600 meters) in the mountains of western China. It is readily distinguished from related species by its smaller, very compactly arranged leaves, which are nearly sessile and strongly cordate at base. The leaves are densely stellate-ferruginous-tomentose on the lower surfaces and are not strongly discolored on the two surfaces as in some other species. The flowers (March–November) are red or yellow on the inside.

2. *Brandisia Swinglei* Merrill in Philip. Jour. Sci. Bot. 13: 157. 1918.

KWANGTUNG: Lofaushan, *E. D. Merrill 10851* (TYPE COLL., NYBG, UC); Lungmen District, Nan Kwan Shan, *W. T. Tsang 25401* (AA), *25438* (AA). KWANGSI: Waitsap District, Tong Shan, *W. T. Tsang 22862* (AA); Yao Shan, *C. Wang 39502* (AA), *40192* (AA).

Scattered shrubs, on mountain slopes at altitudes of about 500–1000 meters, in Kwangtung and adjacent parts of Kwangsi. Flowers pale yellow. Flowering from June to September.

The type of the species was from: "Kwangtung Province, Loh Fau Mountain (Lofaushan), *Merrill 10851*, August 22, 1917, in thickets along small streams, altitude about 950 meters; very rare, a single plant observed." Isotypes in the herbaria of the New York Botanical Garden and the University of California have been seen.

This species is characterized by its large broad leaves with grayish indumentum on the lower surface and the relatively longer and more acuminate calyx-teeth. It has the easternmost range of any species of the genus.

3. *Brandisia laetevirens* Rehder in Sargent, Pl. Wils. 1: 573. 1913.

YUNNAN: Szemao, *A. Henry 12605* (AA TYPE, MBG); Wen-shan District, *H. T. Tsai 51495* (AA); Shih-ping District, *H. T. Tsai 53434* (AA).

A shrub in forests on mountains at altitudes of 1300 to 1800 meters, in southern Yunnan. Flowers yellow. Flowering in January.

The type of the species was from "Yunnan: Szemao, eastern mountains, alt. 1300 m., *A. Henry* (No. 12605)." The holotype in the herbarium of the Arnold Arboretum has been seen.

This species is a close relative of *B. Hancei* and *B. discolor*. It is distinguished from the former by its large, less cordate, and more distinctly petiolate leaves. It differs from the latter notably in the larger calyx and shorter petioles. The corolla of *B. discolor* is also narrower and more densely tomentose and the leaves are darker on the upper surfaces, which become almost black in dried specimens.

4. *Brandisia kwangsiensis* sp. nov.

Frutex scandens, ramulis hornotinis fulvo-tomentosis; foliis chartaceis,

ovato-lanceolatis vel oblongis, longe acuminatis, basi acutis vel subrotundatis, 6–8 cm. longis, 2–3.7 cm. latis, margine integris, supra initio sparse stellato-tomentosis, mox glabrescentibus et glabris, in sicco luteo-viridibus, subtus dense flavescentibus stellato-tomentosis, reticulatis, nervis lateralibus utrinsecus 5–7, adscendentibus conjunctis, supra costa impressa subtus elevata; petiolis 4–8 mm. longis, fulvo-tomentosis; floribus axillaribus, solitariis, pedicellis gracilibus, fulvo-tomentosis, 8–9 mm. longis, medio bibracteolatis, bracteolis subulatis, caducis; calyce campanulato, 10-costato, circiter 1 cm. longo, extus dense tomentosus, intus dense piloso, lobis 5, late triangularibus, acutis, 2–3 mm. longis; corolla late campanulata, leviter curvata, bilabiata, circiter 2.4 cm. longa, rubra, extus dense stellato-tomentosa, limbo intus tomentosus, tubo intus glabro, labio postico magno truncato emarginato, lobo antico 3-lobato, fere dimidio brevior, lobis ovatis acutis; staminibus stylisque corolla subaequilongis; antheris dense pilosis; capsulis ovoideis, dense tomentosius, calyce incluso circiter 1 cm. longis.

KWANGSI: Ling-wun District, in dense woods, *S. K. Lau* 28688 (TYPE AA); Pin Lam, *S. P. Ko* 55685 (AA).

This species is strongly characterized by its relatively narrow leaves with acute to subrounded bases. From other related species, such as *B. Swinglei*, *B. laetevirens*, and *B. discolor*, this new species is also readily distinguished by the nearly concolorous leaves. The upper surfaces of the leaves are only slightly more brownish than the lower, while in the other species mentioned the upper surfaces are much darker and often turn blackish in the dried state. The reddish flowers appear in January.

Besides the two collections mentioned above, another specimen, *R. C. Ching* 6300 (NYBG), collected from Nee Bai, Kwangsi, may be referable to this species. On it the leaf-bases are more rounded. The specimen bears only incomplete fruits.

5. *Brandisia discolor* Hook. f. & Thoms. in Jour. Linn. Soc. Bot. 8: 11. t. 4. 1865; Kurz in Jour. As. Soc. Beng. 42: 236. 1873, For. Fl. Brit. Ind. 2: 250. 1877; Hook. f., Fl. Brit. Ind. 4: 257. 1865; Brandis, Ind. Trees 491. 1906; Rehder in Sargent, Pl. Wils. 1: 573. 1913.

YUNNAN: Szemao, *A. Henry* 12605B (AA, ANSP, MBG, NYBG), *J. F. Rock* 2769 (AA, USNH), *C. W. Wang* 80987 (AA, USNH).

A shrub on ridges in bushes at an altitude of about 1300 meters, from lower Burma to southern Yunnan. Flowers yellow. Flowering in March.

The type of the species is a collection made by Brandis in Martaban, Burma, although no collection is definitely cited with the original description.

This species was originally found in lower Burma and the southern Yunnan plants are apparently referable to it. The species is characterized by the slender distinct petioles, strongly darkened upper leaf-surfaces, and the relatively small calyces and narrow corollas.

6. *Brandisia glabrescens* Rehder in Sargent, Pl. Wils. 1: 574. 1913.

YUNNAN: Mengtze, *A. Henry* 9716 (AA, USNH), 9716A (AA TYPE); Ping-pien District, *H. T. Tsai* 62440 (AA), 62798 (AA).

A slender shrub, in forests at altitudes of about 2000–2300 meters, in southern Yunnan. Flowers yellow. Flowering in July and August.

Rehder cited two collections: "Yunnan: Mengtze, forest, alt. 2000 m., *A. Henry*



(No. 9176A); south of Red River from Manmei, alt. 2300 m., *A. Henry* (No. 9716).” Both are in the herbarium of the Arnold Arboretum, the first being designated by Rehder as the type. The number, however, should read 9716A.

This species is characterized by the long calyx. Besides this distinct calyx-character, it can also be readily distinguished from the related *B. discolor*, *B. Hancei*, etc., by the sparsely pubescent leaves, which are rounded to broadly truncate at the base.

7. *Brandisia rosea* W. W. Smith in Notes Bot. Gard. Edinb. 10: 10. 1918.

SIKANG: Tsarong, Salween-Chingkiang Divide, *G. Forrest* 20320 (AA, USNH). YUNNAN: Western flank of the Tali Range, *G. Forrest* 11565 (AA, RBGE TYPE, UC); Shang-pa District, *H. T. Tsai* 54774 (AA), 54859 (AA), 56644 (AA); Che-tse-lo, *H. T. Tsai* 54172 (AA), 58548 (AA); Chungtien, Wu-tso on the Yangtze bank, *K. M. Feng* 3344 (AA).

In woods or open thickets on mountain slopes at altitudes of 2100 to 3000 meters, in northwestern Yunnan and adjacent Sikang and also in eastern India. Flowers deep rose to reddish orange. Flowering from July to September.

The type of the species is from western Yunnan: “China, western flank of the Tali Range, Yunnan. Lat. 25° 40' N. Alt. 10,000 ft. Shrub of 3–5 ft. Flowers deep rose. Open dry situations amongst scrub. July 1913. *G. Forrest*. No. 11,565.” The holotype in the Edinburgh Herbarium has been seen.

*Brandisia rosea* is distinctly characterized by the bilobed calyx. In this respect, it deviates from the original generic limits. It also differs from other species in its general appearance, especially in the relatively narrow long-attenuate leaves which are sometimes oppositely arranged. In view of these differences, it is here segregated as representing a different subgenus. The fruit and seed characters are the same as in the other species.

A variety with yellow flowers was described by Fischer, from Assam, India, as *Brandisia rosea* W. W. Smith var. *flava* C. E. C. Fischer, in Kew Bull. 1934: 93. 1934. In the Genera Plantarum, it is stated that, besides the original *B. discolor*, there is another species in India. Hooker, in the Flora of British India, said: “The supposed second species of *Brandisia*, alluded to in the ‘Genera Plantarum’ as a native of Bhotan, has stellate tomentum, lanceolate leaves and a 2-lipped calyx, and cannot be congeneric.” Fischer identified this plant as belonging to *B. rosea*. He said: “Griffith’s specimen [*Kew Dist.* 3748] from Bhutan, referred to in the Gen. Pl. and in the Fl. Brit. Ind., and a sheet collected by Nuttall also in Bhutan (both in the Kew Herb.) are this species, but being in fruit only it cannot be determined whether they represent the typical species or the colour variety.”

8. *Brandisia racemosa* Hemsl. in Kew Bull. 1895: 114. 1895; Oliver in Hook. Ic. Pl. 24: t. 2383. 1895; Schneider, Ill. Handb. Laubholz. 2: 618. fig. 399, c-h. 1911; Rehder in Sargent, Pl. Wils. 1: 574. 1913; Hand.-Mazz., Symb. Sin. 7: 831. 1936.

YUNNAN: Mengtze, *Hancock s. n.* (UC), *Henry* 9973 (AA, MBG, NYBG, USNH), *M. Leduc s. n.* (ANSP); Siao-ho, *E. E. Maire* 3986 (ANSP, B); Mongkou, *E. E. Maire* 10199 (NYBG, UC); Kiang-pien, *E. E. Maire s. n.* (ANSP); Kiao Kia, *F. Ducloux* 989 (NYBG, UC); near Kun-ming, *H. Handel-Mazzetti* 5051 (AA, USNH).

A spreading shrub, at altitudes of 800 to 2800 meters, in Yunnan. Flowers scarlet. Flowering in September.

Hemsley's type was from "Western China, in shady copses, Mongtze, Yunnan, *Hancock*, 143." It has not been seen. The description and original illustration by Oliver are distinctive. Two specimens collected by Hancock in the type locality in 1896 are in the herbarium of the University of California.

*Brandisia racemosa* is a most unique species of the genus, distinguished not only by the peculiar corolla-structure but also by the inflorescence. The flowers are arranged in short or long racemes. The calyx is shortly and inconspicuously 5-dentate. The corolla is strongly bilobed, the upper lip being much longer than the lower. The lower lip is 3-lobed, with the two lateral lobes adnate to the sides of the upper lip midway in the corolla and the middle lobe attached much lower in a deep notch between the two lateral lobes.

The plant also differs from other species of the genus in general appearance, with its long straggling branches and relatively smaller and more distinctly serrate leaves. The whole plant is blackened in the dried state, indicating its possible parasitic or semi-parasitic habit. Rehder mentioned that: "It was introduced by Mr. Wilson into cultivation, but it could not be grown successfully, as it is apparently parasitic and its proper host plant is not known."

Although the plant differs radically from other species of the genus in many respects, its basic characters in the stamens, fruits, and seeds agree with the genus in general. It is thought best to retain it in the genus but to designate a subgenus for its sole accommodation.

#### DOUBTFUL AND EXCLUDED SPECIES

*Brandisia praticola* W. W. Smith in Notes Bot. Gard. Edinb. 10: 10. 1918.

This species is based on *Forrest 13350* from northwestern Yunnan. The type, in the Edinburgh Herbarium, is available for study. It proves to be *Pterygiella nigrescens* Oliver.

*Brandisia Souliei* Bonati in Bull. Soc. Bot. France 56: 467. 1909.

This species is based on *Soulié 5199* from Yargong, Sikang Province. It has not been seen. According to the description, this species is distinguished by the 3-verticillate leaves, which are concolorous on the two surfaces, the flowers in axillary cymes, the membranaceous calyx with its 5 lobes subulate and splitting at the tips, etc. It does not represent the genus *Brandisia* but belongs in the Labiatae. A short discussion of this misplaced species will be issued in this Journal in the near future by Prof. E. D. Merrill.

## THE CYTOGENETICS OF GENERIC HYBRIDS OF SORBUS

HALLY J. SAX AND KARL SAX

*With one plate*

THE POMOIDEAE constitute a group of rather closely related genera of common origin (Sax, 1933). All genera have a basic chromosome number of 17 and generic hybrids are relatively common. Natural hybridization is most frequent between *Sorbus* and the related genera *Aronia*, *Amelanchier*, and *Pyrus*. Rehder (1940, 1947) has described or enumerated seven hybrids between *Sorbus* and *Aronia* species, three hybrids of *Sorbus* and *Amelanchier*, and one hybrid between *Sorbus* and *Pyrus*. These genera are closely related and have been included in a single genus *Pyrus* by some taxonomists.

The nomenclature in the following descriptions is that of Rehder (1940). The cytological analysis is based upon acetocarmine smear preparations, following fixation in alcohol-acetic acid.

Hybrids between *Sorbus* and *Aronia* include *Sorbaronia Jackii*, *S. Arsenii*, *S. hybrida*, *S. fallax*, *S. heterophylla*, *S. alpina*, and *S. Dippelii*. Both the pinnate- and entire-leaved species of *Sorbus* have produced hybrids with *Aronia species*, all of which have entire leaves. *Sorbaronia Dippelii* has been crossed with *Sorbus alnifolia* in the Arnold Arboretum. Three of the *Sorbaronia* hybrids, *S. Jackii*, *S. alpina*, and *S. Dippelii*, have been examined cytologically and attempts have been made to grow  $F_2$  generations.

*Sorbaronia Jackii* is a naturally recurring hybrid between *Sorbus americana* and *Aronia prunifolia*. Specimens of the *Sorbus* parent in the Arboretum, both mature trees and 2-year old seedlings, have from 5 to 8 pairs of leaflets with an average number of slightly less than 7. The  $F_1$  hybrid has variable leaves, ranging from entire, as in *Aronia*, to pinnate leaves with as many as 3 pairs of leaflets in addition to the terminal leaflet. Often the leaves are partially pinnate or lobed. The average number of leaflets is 1.4.

The open pollinated progeny of *S. Jackii* are extremely variable in size and viability. Of 50 seedlings selected from the survivors grown in the greenhouse, seven have died in the nursery at the end of the second year, seven are extreme dwarfs, and 36 have made more or less normal growth. All surviving seedlings have at least partially pinnate leaves, ranging from 3 to 7 leaflets with an average of 4.5. No segregates had any entire leaves, but these progeny may be back cross hybrids with adjacent pinnate-leaved species of *Sorbus*. Seedlings of *Sorbus americana* grown in the nursery showed much greater uniformity than those of the hybrid. Of 50 seed-

lings, only one had died at the end of the second year.

*Sorbaronia Jackii* produces abundant fruits, but much of the seed is defective or produces weak seedlings — pollen sterility is variable, ranging from 0 in some anthers to about 50 per cent in others.

The meiotic divisions were generally irregular, but in some pollen mother cells the divisions appeared to be relatively normal. At first meiotic metaphase there were from 13 to 15 bivalents and from 4 to 8 univalents in most of the figures examined, although the number of univalents ranged from 0 to 12. Lagging univalents were generally found at both first and second anaphase (PL. I, FIG. 1). The tetrads resulting from the two meiotic divisions were often irregular with some micronuclei, but as a rule nearly 50 per cent of the pollen appeared to be morphologically normal.

*Sorbaronia alpina* is a cross between *Sorbus Aria*, a species with simple leaves, and *Aronia arbutifolia*. This hybrid, as represented by the variety *super-aria*, is more sterile than *Sorbaronia Jackii*. Occasionally there appeared to be 17 bivalent chromosomes at the first meiotic metaphase, but the divisions were generally quite irregular, with as many as 14 lagging univalents at anaphase. For some anaphase figures the lagging chromosomes appeared to include an occasional bivalent (PL. I, FIG. 2). The second meiotic divisions also were irregular and the pollen fertility ranged from 0 to 24 per cent. For both of these *Sorbaronia* hybrids the pollen sterility varied greatly in different flowers and some anthers contained no good pollen. Some fruits are produced by *S. alpina*, but we have not been able to germinate the seeds.

*Sorbaronia Dippelii* is a hybrid between *Sorbus Aria* and *Aronia melanocarpa*. This hybrid is relatively fertile, as indicated by both pollen sterility and by fruit development. Yet some anthers produce no good pollen and we have not been able to germinate open pollinated seed. Seventeen bivalent chromosomes were found at meiotic metaphase (PL. I, FIG. 3), and there was little irregularity at meiotic anaphase. Pollen development was variable, but some counts showed as high as 58 per cent normal pollen. The pollen fertility of the *Aronia* parent was only 76 per cent and that of the *Sorbus* parent about the same.

We have succeeded in crossing *Sorbaronia Dippelii* with the distinct *Sorbus* species *S. alnifolia*. This hybrid has the characteristic foliage of *S. alnifolia*, the male parent. It is a slow growing shrub and has not yet flowered.

Several hybrids between *Sorbus* and *Amelanchier* have been described. The three known hybrids are growing in the Arnold Arboretum, but only *Amelasorbus Jackii* is large enough to provide meiotic material. This hybrid was found among seedlings grown from seeds collected in the Moscow mountains of Idaho by Professor J. G. Jack. It is described by Rehder as a hybrid between *Sorbus scopulina* and *Amelanchier florida*. According to Professor Jack there were two types of the hybrid, one with partially pinnate leaves and one with only an occasional cleft or lobed leaf. Only the latter type is now available in our collections.



*Amelasorbus* has been difficult to analyse cytologically. The microspore mother cells appear to disintegrate at any stage of development from prophase to microspores. In favorable prophase preparations 32–34 chromosomes were counted at diakinesis, indicating a very loose association of paired chromosomes. At meiotic metaphase there were from 12 to 15 bivalents and from 4 to 10 univalents (PL. I, FIG. 4). At anaphase the number of lagging univalents are variable, but as many as ten have been observed (PL. I, FIG. 5). Although the meiotic behavior of the chromosomes of *Amelasorbus* is similar to that of two of the *Sorbaronia* hybrids, the sterility is much greater. Practically no normal pollen is formed and very little fruit is produced. Over a period of years only two viable seeds have been obtained and the resulting seedlings, which have now flowered for several years, are very similar to the parental hybrid in both appearance and sterility. Apparently they are of parthenogenetic origin.

Two other forms of *Amelasorbus* are listed by Rehder (1947). *Amelasorbus Hoseri* is thought to be a hybrid between *Sorbus hybrida* and *Amelanchier* sp. It has partially pinnate leaves. *Amelasorbus Raciborskiana* is listed as a cross between *Sorbus* sp. and *Amelanchier asiatica*. It too has partially pinnate leaves. Both of these hybrids were raised at the Kornik Botanical Garden in Poland and named by Wroblewski. Our specimens of these hybrids are not sufficiently mature for meiotic analysis.

The known crosses between *Sorbus* and *Pyrus* are limited to *Sorbopyrus auricularis*, a natural hybrid between *S. Aria* and *P. communis*. We have in the Arnold Arboretum only the variety *bulbiformis*, a form which resembles *Pyrus* in most characters. This hybrid is a triploid with presumably two sets of pear chromosomes. Its cytological behavior has been described earlier (Sax 1932). We have obtained some progeny from open pollinated seeds of *Sorbopyrus*. The seedlings are variable but tend to segregate into two groups—some which are vigorous and resemble the mother tree, and a series of dwarf segregates which survived for one to three years.

In all of these generic hybrids involving *Sorbus* there is considerable sterility, and when segregates are obtained many are weak and do not survive. The genera *Sorbus*, *Aronia*, *Amelanchier*, and *Pyrus* can be crossed only in certain combinations. One might suppose that *Aronia* and *Amelanchier* could be crossed, since both have produced at least several hybrids with *Sorbus*, but repeated attempts to cross these genera have failed. However, we also have been unable to produce any artificial hybrids between *Aronia* and *Sorbus*, and yet seven such spontaneous hybrids are known and some are recurrent in nature.

The fact that *Sorbus*, *Aronia*, *Amelanchier*, and *Pyrus* can be crossed in certain combination indicates a certain degree of similarity. The behavior of the hybrids does indicate cytogenetic differentiation usually found in diverse species. Whether such incompatibility merits more than specific differentiation is a matter of taxonomic convenience.

## SUMMARY

Natural hybrids between *Sorbus* and *Aronia* and between *Amelanchier* and *Pyrus* are partially sterile and show considerable meiotic irregularity. *Sorbaronia* produces a variable progeny both in morphological characters and viability. *Amelasorbus* produces few viable seeds and the progeny appear to be of parthenogenetic origin. *Sorbopyrus* sets few seeds and the progeny include many dwarf segregates which survive for only a few years. The cytogenetic analysis indicates a common origin of these genera, but a degree of differentiation sufficient to maintain generic isolation.

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## EXPLANATION OF THE PLATE

Drawn from acetocarmine preparations. Magnification approximately  $\times 2000$ .

FIG. 1. *Sorbaronia Jackii*. First meiotic anaphase. FIG. 2. *Sorbaronia alpina super-aria*. First meiotic anaphase. FIG. 3. *Sorbaronia Dippelii*. First meiotic metaphase. FIG. 4. *Amelasorbus Jackii*. First meiotic metaphase. FIG. 5. *Amelasorbus Jackii*. First meiotic anaphase.

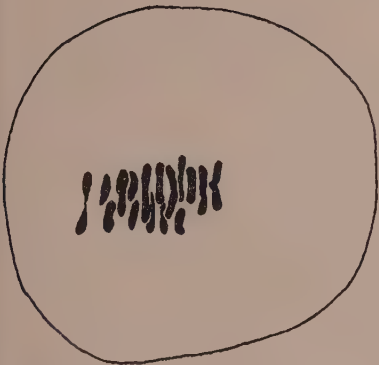
ARNOLD ARBORETUM,  
HARVARD UNIVERSITY.



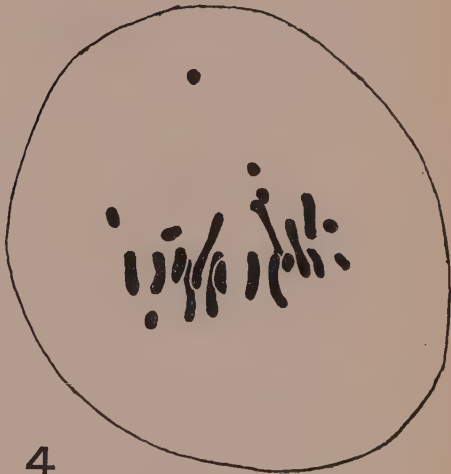
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## A FIJIAN ACMOPYLE

JOHN T. BUCHHOLZ AND NETTA E. GRAY

*With one plate*

AMONG the collections of John W. Gillespie from the Fiji Islands is a single specimen (no. 3273, from Namosi Province, Viti Levu) which represents a species of *Acmopyle*. This specimen had been included in a loan of material of *Podocarpus* from the herbarium of the Arnold Arboretum and had been inadvertently identified as *Podocarpus vitiensis* Seem. It differs in many important features, both externally and internally, from *P. vitien-sis*, and it agrees so generally in the anatomy of the leaves with *Acmopyle* Pilger that there can be no doubt about the generic identity. Specifically it differs somewhat from *Acmopyle Pancheri* (Brongn. & Gris) Pilger in several details, such as the external shape of the leaves and their texture, width, and apex.

This is not the first report of *Acmopyle* in the Fiji Islands. Sahni (in Phil. Trans. Roy. Soc. London B, 210: 253–310. 1920), in his treatise on the structure and affinities of *Acmopyle*, mentions an earlier collection by J. Horne in 1877–78, found in the herbarium of the Royal Botanic Gardens, Kew, which he examined in considerable detail. Sahni concluded that this specimen represents a species of *Acmopyle*. He also records the opinion of Dr. Stapf, who examined this material and who “does not consider it likely that the Fiji specimen is specifically identical with *Acmopyle Pancheri*, but he agrees to the generic identity.”

We have examined the leaves of the Gillespie specimen histologically, and also those of *Acmopyle Pancheri*, numerous specimens of *Dacrydium falciforme* (Parl.) Pilger, and some of *Dacrydium taxoides* Brongn. and Gris. Details given by Sahni concerning the flattening of the leaf in these species in the vertical plane, with the vascular bundle remaining in an unchanged orientation, can be substantiated in all essentials. The vascular bundles therefore appear as if turned sidewise through 90° with reference to the leaf surface. The above mentioned two species of *Dacrydium*, representing a special section of that genus, and the two species of *Acmopyle* share in this unusual type of leaf. Leaves of the *Dacrydium* spp. possess hypoderm and are bifacial, having palisade tissue and stomates on both sides, while the leaves of *Acmopyle* found on the pectinate twigs of the last order of branching have very little or no hypoderm, palisade tissue only on the upper side which is exposed to light, and the stomates confined almost entirely to the lower surface of the leaf. The unique type of leaf anatomy therefore serves to segregate *Acmopyle* from other genera of the Podocarpaceae.

*Acmopyle Sahniana* sp. nov.<sup>1</sup>

Arbor parva; foliis spiraliter insertis, in ramulis ultimis biseriatim in una planitie expansis, basi in ramulum longe decurrentibus; laminis falcatis, 16–19 mm. longis, 3.5–4 mm. latis, supra nitido-viridibus, marginibus foliorum subparallelibus sed in apicem oblique acutum terminantibus, costa supra non conspicua; floribus masculis seminibusque ignotis.

Leaves with two bands of stomates in 14–18 irregular rows each beneath, interrupted only slightly at midvein and leaving wide non-stomatiferous bands at borders; single vascular bundle within leaf turned through 90°, the xylem toward the adaxial margin, the phloem and single resin canal toward the abaxial margin of the leaf.

FIJI ISLANDS: VITI LEVU: Namosi: Mt. Vakarongasiu, alt. 900 m., on an exposed ridge, *John W. Gillespie* 3273 (TYPE in herb. Arnold Arb.), Oct. 2, 1927.

*Acmopyle Sahniana* may be distinguished from *A. Pancheri* (Brongn. & Gris) Pilger by the wider leaves, the more nearly parallel leaf-margins, and the obliquely acute apex. The leaves of *A. Pancheri* are usually 2.5–3.5 mm. wide, are gradually narrowed toward the tip, have a narrow rounded apex, and are thicker. Both species have the vascular bundle turned through 90° and are without hypoderm or have only scattered fibers of hypodermal tissue near the midvein of the leaves. The midvein is not centrally placed in *A. Sahniana*. The wider margin is in the adaxial position and this convex adaxial edge near the base of leaf is much thinner than in *A. Pancheri*.

OTHER SPECIMENS EXAMINED FOR COMPARISON<sup>2</sup>*Acmopyle Pancheri* (Brongn. & Gris) Pilger

NEW CALEDONIA: Mt. Mou, *I. Franc* 170 (A, US), *Le Rat* 2594 (A), *Louisa Clark Williams* 149 (Bish).

*Dacrydium taxoides* Brongn. & Gris

NEW CALEDONIA: Cougui, *Pancher* 379 (NY).

*Dacrydium falciforme* (Parl.) Pilger vel aff.

Group A. Specimens resembling the original descriptions: MALAY PENINSULA: *R. E. Holtum* (Singapore field no. 20626) (UC); PAHANG: Fraser Hill, 4000 ft., Aug. 25, 1923, *M. Nur* 10507 (A). BORNEO: BRITISH NORTH BORNEO: Mt. Kinabalu, Marai Parai, *M. S. Clemens* 10962 with seed (UC), *J. & M. S. Clemens* 33078 (A, UC); Mt. Kinabalu, Penibukan, *J. & M. S. Clemens s. n.* (A); SARAWAK: Mt. Poi, *J. & M. S. Clemens* 20263 (A); NETHERLANDS BORNEO: Res. Wester-Afdeeling, Bengkajang, Banan, *Neth. Ind. For. Service* 24778 (A); (locality?), Batu Gajah Lugga, *B. W. Hullett* 5695 (A). CELEBES: Res. Manado, Paleo, 1400 m., *Neth. Ind. For. Service* 17544 (A). PHILIPPINES: MINDORO: Mt. Halcon, *E. D.*

<sup>1</sup> Named in honor of Professor Birbal Sahni, F. R. S., of Lucknow, India, in recognition of his comprehensive study of the morphology of this genus. Prof. Sahni, also distinguished through his researches in paleobotany, was born in India in 1891 and was educated at Punjab and at Cambridge (Eng.) Universities. He is now Professor of Botany and Dean of the Faculty of Science at the University of Lucknow.

<sup>2</sup> Place of deposit of specimens is shown by the parenthetical letters, as follows: (A) Arnold Arboretum; (Bish) Bernice P. Bishop Museum; (NY) New York Botanical Garden; (UC) University of California; (US) United States National Herbarium.



A FIJIAN ACMOPYLE







*Merrill 5744* (NY); LUZON: Mt. Umingan, *M. Ramos & G. Edaño 26394* (A, NY); *G. Edaño*, Philip. Nat. Herb. no. 4508 (A).

Group B. Specimens with leaves smaller than those of Group A: NEW CALEDONIA: Mt. Mou, *C. J. Pitard 2091* (A, NY). BRITISH NEW GUINEA: *C. E. Lane-Poole 397* (smallest leaves) (A).

#### EXPLANATION OF THE PLATE

- A. *Acmopyle Sahniana*, from Viti Levu, Fiji Islands, *Gillespie 3273* (A).  
B. *Acmopyle Pancheri*, a twig from *Williams 149* (Bish), for comparison.

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and  
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